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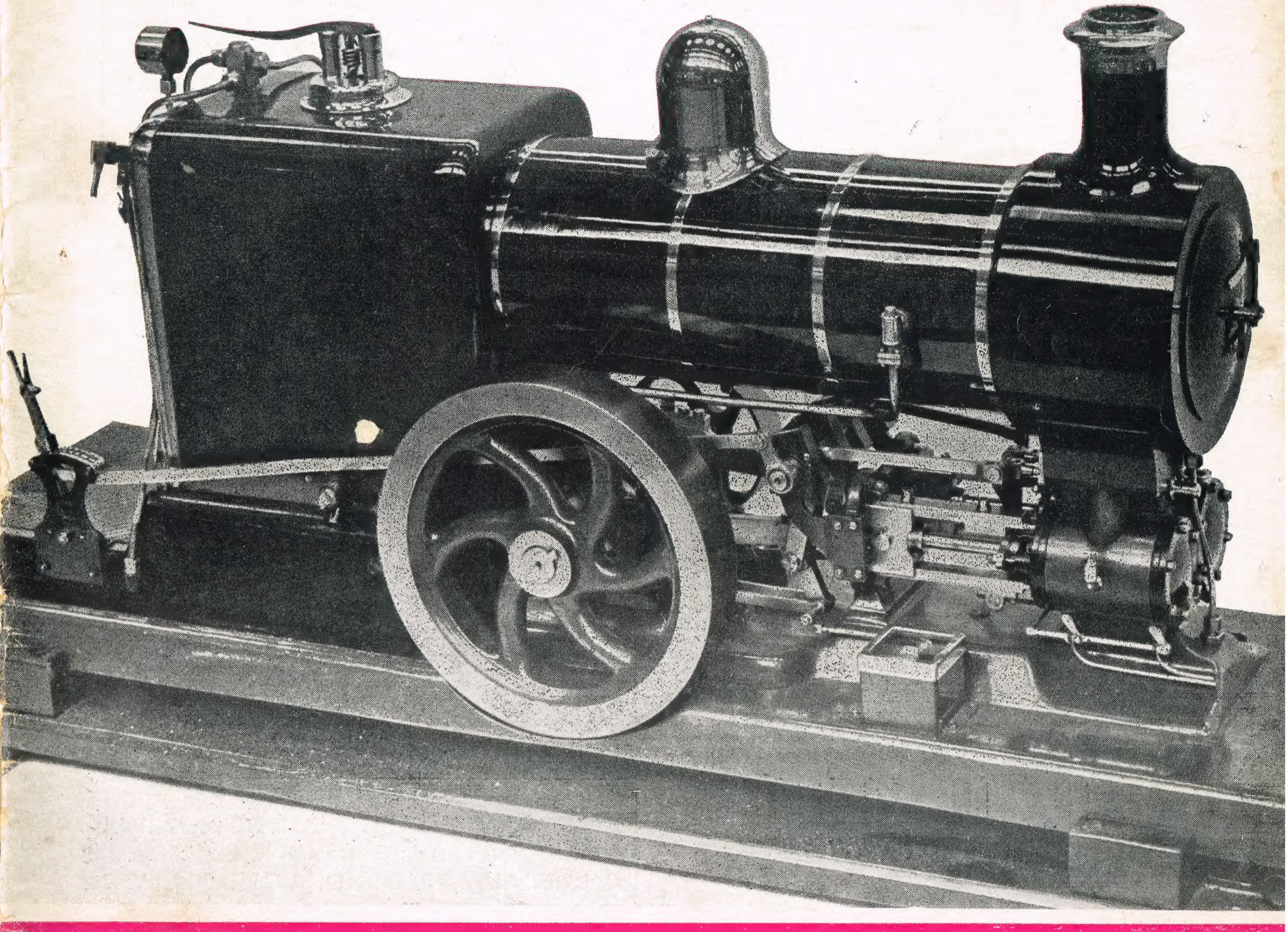
Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

FREE LANCE DESIGN

UNDERTYPE STEAM—ENGINE



ONE SHILLING 18 APRIL 1957 VOL 116 NO 2917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Model Engineer

18 APRIL 1957 VOLUME 116 No 2917

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Incorporating SHIPS AND SHIP MODELS

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All correspondence should be addressed to the Editor, Model Engineer, 19-20, Noel Street, London, W.1.

Smoke Rings

A WEEKLY COMMENTARY BY VULCAN

MODEL ENGINEERING, as a hobby, has an almost unlimited scope for scientific reasoning and variety of interest, and so long as it remains a hobby it must attract technically-minded enthusiasts who like to think things out for themselves.

This, of course, applies to *working* models more particularly, simply because the problems concern the methods to be used in making the models work satisfactorily, and as economically as possible.

We are now at the threshold of a new era, the Atomic Age, which would seem to open up new possibilities for the model engineer. A new source of energy has been discovered and the very first problem for the model engineer to solve will be how to adapt the new form of energy to model purposes. Is it to be simply a substitute for fuel—a new kind of fuel, in fact? Or, will there be discovered some method whereby the necessary energy can be released at or close to the point where it is needed?

Previous examples

There can be little doubt that these two questions will engage the attention of model engineers possessed of inquiring minds and an enthusiasm for practical research, and who knows what may be the outcome?

It is interesting to recall the past history of the application of power to the operation of models. It took nearly 120 years to develop the model steam-engine into the highly successful power unit it is today; and broadly speaking, the major and most rapid developments have taken place in the last 40 years or so. Even now, he would be a clever man who could prove that the model steam-engine has reached finality.

The miniature turbine, whether steam or gas, less than a quarter of a century ago was thought to be impossible. The same can be said of the miniature internal combustion engine and the compression-ignition engine. All these, except the gas-turbine, are common objects now, and I have heard some mention of a model turbo-generator which is under construction.

The plain fact is that when the model engineer comes face to face with an "impossible" problem, he promptly sets out to solve it! Back volumes of MODEL ENGINEER record many instances of this kind of thing, and there seems to be no reason why future volumes should not record many more. On the contrary, there is every reason why they should, no matter how long it should take.

Passing fancies?

A PERSON whose teen-age son is very interested in model engineering, and wishes to set up a workshop, recently asked my opinion whether it was worth while to go to this trouble and expense for a project which, as

SMOKE RINGS . . .

he suggested, might be " only a passing fancy."

It is, of course, very difficult to pass judgment on individual cases, especially without intimate knowledge of the persons concerned, but it is fairly safe to say that genuine interest in model work or craftsmanship of any kind is no mere transient craze but almost invariably lasts a lifetime.

With the many counter attractions of the modern age, it is not very easy to interest youths in a pursuit which demands patience, perseverance and arduous self-training, but any signs of a real urge to take up any creative hobby should be given every encouragement. At the same time, however, we do not consider it necessary or desirable to plunge into great expense to provide the beginner with an elaborately equipped workshop.

A few simple tools to begin with, and the promise to follow up his progress in learning how to use them with equipment capable of more advanced work will not only prove just how serious his interest is but also provide better training than a super-workshop where everything works by pressing a button.

There is only one way to learn craftsmanship; it is necessarily a hard and tedious way, but anyone who is prepared to pursue it will find the effort well worth while.

Do scuppers swim . . .

I DOUBT if anything more entertaining will be written about *Mayflower II* than the article which Majdalany (rhymes with " brainy ") of the *Daily Mail* presented to his chuckling readers after a visit to Upham's Shipyard at Brixham.

Majdalany's brisk summary of American history since the Pilgrim Fathers was itself a contribution to Ango-American Relations, " the most important relations of all except mothers-in-law and rich godparents." As for ship modellers and other ship-lovers—well, I will quote from his interview with Stuart Upham :

" ' Rigging,' said Mr Upham, flinging some ropes lovingly, ' is the engine of this ship.'

folded or flat ?

" The old shipbuilders, it seems, were careless about leaving behind plans and blueprints. Mr Upham had to summon up the tenacity of a scholar, the intuition of an historian, and the inherited knowledge of generations of shipbuilding to work out just how the rigging was made and arranged. It took him 15 months."

Majdalany also learnt something (but what ?) about tapering ropes.

" Apparently," he wrote, " it is difficult to make a rope taper. Not having C. S. Forester with me to act as interpreter, I am not too sure I understand even now the purpose of this tapering—' one end small enough for belaying, the other heavy enough to make the massive tack-knot required at this other end for a sheet-block, clew-garnet block, and tack to the clew-cringle of the maincourse.'

" But, by Heaven, I'm impressed !

" ' There was the question of holes,' Upham said suddenly, bouncing a belaying-pin to show me how seasoned the wood was. ' Should the holes in the dead-eyes be round or oval, flat or countersunk ? '

" We spent most of a morning slapping timbers, climbing ladders, caressing rigging."

Commander Alan Villiers, master of MAYFLOWER II, *at a reception held for members of his crew. The* MAYFLOWER II *is sailing from England to America to re-enact the journey of her 17th century namesake. Passengers and crew will wear historic costume. With Villiers are : Margaret Mead of Palmers Green, Patricia Field of Streatham (in Quaker costume), and Geoffrey Wickstead.*

Cover picture

A model of an undertype engine. This type of engine was once very popular for light industrial duties where a compact, self-contained unit was necessary. There must be very few full-size examples now in existence in this country.

New look in liners

THE FIRST big passenger ship to have its machinery aft—and up to the present the only one—is the Shaw Saville liner *Southern Cross* built in 1955.

There has been no great rush to copy the idea, but now that this layout has been adopted for the new 45,000 ton P. and O. liner, the order for which was placed recently with Harland and Wolff of Belfast, the fashion is likely to spread.

There are obvious advantages in the arrangement: the engines and machinery are to a great extent isolated from the main body of the ship, thus relieving passengers from most of the noise, vibration and fumes inseparable from a large power plant, and the accommodation can be planned to better advantage.

Having the funnel aft gives the ship a rather unsymmetrical appearance, and the new arrangement takes a bit of getting used to; but the comfort of the passengers will in the long run be the deciding factor, and there is little doubt but that the new look has come to stay.

In *Southern Cross* an attempt has been made to obtain a certain symmetry by combining the mast with a funnel somewhat like the funnels aft, but here again is a new and rather disturbing feature in that there are two funnels aft and that they are side by side.

The MUNCASTER steam-engine models

EDGAR T. WESTBURY is bringing a modern eye to bear on some classic models of the past

Continued from 4 April 1957, pages 488 to 490

5—Vertical stationary engines

ALTHOUGH the horizontal type of engine has always been favoured for stationary work, the alternative direct-acting form of engine having the cylinder located vertically above the crankshaft has some advantages where floor space is limited, and is generally considered more suitable for running at high speed than the former type.

It is, of course, more common in marine practice than stationary work, but both on land and sea it has been extensively used for auxiliary purposes such as driving electrical generators, ventilating and forced draught fans, and centrifugal pumps for circulating water in condensing plant, or dock drainage.

One of the earliest engines in this general class was introduced a few years after the Nasmyth hammer made its appearance, and because of its structural similarity to the latter machine it was customary to refer to it as the " steam-hammer " type.

The salient features of such engines, an example of which is illustrated in Fig. 26, include a relatively small bedplate on which is mounted a symmetrical pair of cast columns, usually of channel or hollow-box section, and these in turn support the cylinder assembly. In outline, the structure bears a resemblance to that of a lighthouse, tapering more or less gracefully from the cylinder head to the base, to give maximum rigidity against both dead load and working stresses.

The inside faces of both the columns are flat near the top end, and have machined surfaces which serve as crosshead guides. The working parts are generally similar to those of horizontal engines, except in certain points of detail which may be influenced by their disposition and order of motion.

In one respect, this particular engine may be regarded as an anachonism, in that while its main structure follows the " steam-hammer " tradition, it is fitted with a piston valve, a feature which did not become popular until later developments, and particularly higher steam pressures, made it desirable. However, Muncaster knew steam-engine practice better than I ever shall and I would never dispute his authority over such details.

A piston valve is nothing more than a slide-valve having a circular instead of a flat face, but this alteration in shape involves characteristics which may have advantages or limitations according to circumstances. First of all, it is capable of controlling ports all round its circumference instead of over a limited width of face, and thus it can give much more rapid and efficient valve events than a normal flat valve, though this feature is not always used to full advantage.

Secondly, it is not pressed hard against the portface by the steam pressure, and therefore works with much less friction, especially where high working pressure is employed; this is perhaps its most important practical advantage.

But because of being pressure-balanced it is not self-seating, and unless it is very carefully fitted to the bore of the steam-chest or liner, it is liable to leakage, much more so than the flat valve. Many small piston-valve engines have been found less efficient than those with flat valves for this reason, especially when wear has taken place; large engines have piston rings fitted to the valve to avoid leakage, but this is hardly practicable in a model.

Thirdly, piston valves may be adapted to control steam admission either on their outer end faces (as in the case of the flat valve), or the inner faces, which would normally control exhaust events. The latter arrangement, known as " inside admission," is generally preferred as it enables the steam-chest and passage design to be simplified, though it makes no difference to efficiency so long as design is adapted to suit.

It will, of course, be clear that in this case steam lap must be provided by reducing the width of the clearance portion of the valve, corresponding with the cavity of the flat valve, and the total length of the valve must be such that it exactly covers the ports in the steam-chest, unless exhaust lap is specified—in other words, normal " line for line " exhaust timing.

Piston valves generally allow the cylinder steam passages to be made shorter and more direct, thus improving thermal efficiency by reducing the dead volume at the ends of the stroke and also the conducting surface area of the passages. They do not, however, provide the same facility for visual valve timing as the flat valve, and it is necessary to adjust their position by exact measurement in most cases.

The piston valve of the engine shown in Fig. 26 is of the inside admission type, the main steam inlet being in the centre of the steam-chest and the exhaust being taken out from two ports at the extreme ends to a passage shown in the plan section *BB*. It is driven by a rod which passes up through a clearance hole in the centre for most of the length of the valve, thus giving a small amount of side freedom for self-centring in the gland, but the upper end is screwed into a short tapped hole and a locknut is provided so that lateral position adjustment can be obtained.

It should be noted that for an inside admission valve the eccentric timing must be adjusted so that it trails *behind* the crank instead of leading it. The angle of advance, however, is still in the same direction, so that for a valve with fairly orthodox lap and lead, calling for 30 deg. angle

Muncaster models . . .

of advance, the setting will be 90 — 30 = 60 deg. behind the crank in the direction of engine rotation.

Details of the piston valve and the two short half-liners, which are pressed into opposite ends of the steam-chest, are shown in Fig. 27. Three ports are shown in each of the half-liners, giving a large total area, and the sides of the ports are cut obliquely to minimise ridge formation on the valve as a result of wear. Alternatively, a greater number of round holes may be used, and personally I should favour this method.

A groove is turned in the outside of the liner to form an annular passage when it is inserted in the steam-chest. The liners must be accurately located to give the designed port timing in conjunction with the valve dimensions. A stainless steel valve with bronze liners is recommended.

MAIN COLUMNS

In order to ensure accuracy in cylinder location and guide alignment, I recommend that the columns should first be machined on the guide faces and then clamped together for facing the top and bottom surfaces. When erecting the columns, they should first be bolted to the bedplate with a gauge block between the guides to locate them the correct distance apart. To locate the cylinder, the machined crosshead, or a dummy made to the same dimensions, may be fitted to the piston-rod to ensure correct alignment.

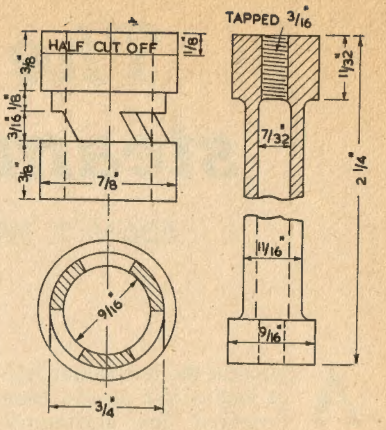
If straightforward machining methods are used, accuracy should be positive, but it is not advisable to take anything for granted and routine checks should be made at all stages of assembly.

SINGLE-COLUMN VERTICAL ENGINE

The "steam-hammer" type of engine is suited equally well for running in either direction, as the crosshead guides are symmetrical and of equal bearing area each side; but this is but rarely called for in stationary work. Even marine engines do not often run for very long periods in the reverse direction. In such cases, a lighter but quite adequate form of structure can be adopted in which only one cast column is employed, and the crosshead is of the slipper type, having its major bearing surface on the soleplate, which slides on the face of the column.

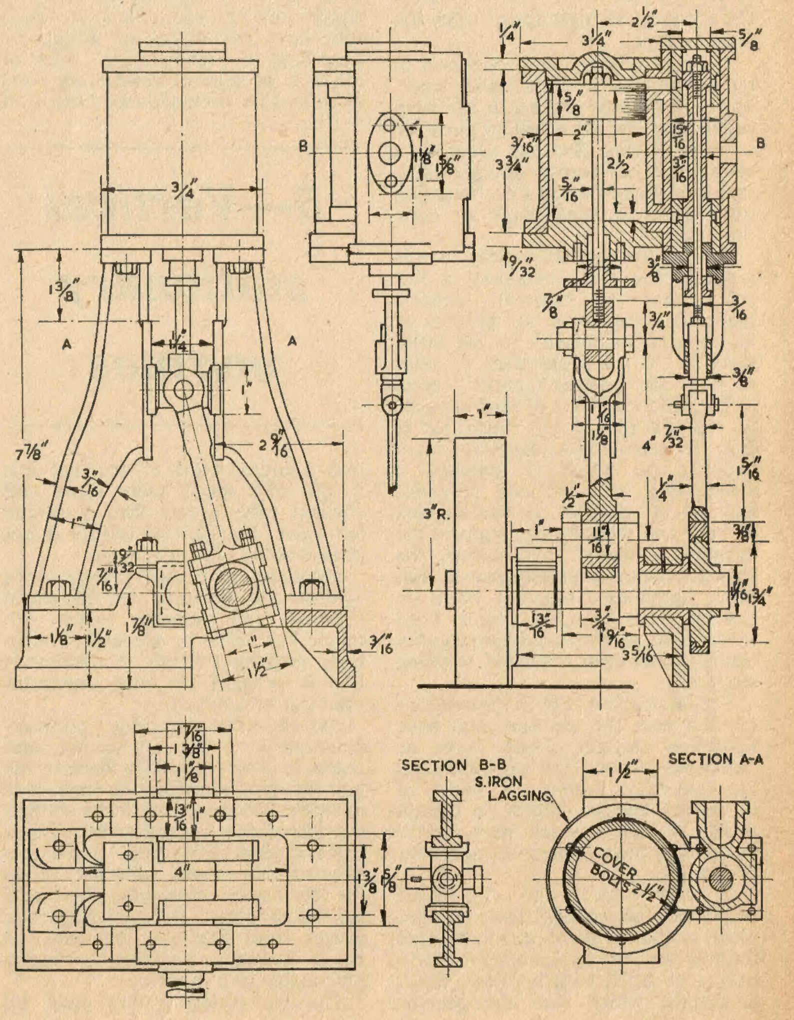
An engine of this type is illustrated in Fig. 28. It is intended to run in a clockwise direction, looking at the end of the shaft as seen in the right-hand elevation. Note that when the piston is on the up-stroke, the thrust, which is tending to straighten out the piston rod and connecting rod linkage, presses the crosshead against the column; but on the down-stroke, the tendency is to increase the angularity of the linkage and thus the crosshead is still pressed against the column.

If the engine rotation is reversed, the side thrust on both strokes is in the opposite direction so that the crosshead will pull away from the column and bear against the keep plates, which are of much smaller surface area than the column face, besides having to rely on their retaining studs for security.



Above, Fig. 27: Details of the piston valve and ported half-liners

Below, Fig. 26: A vertical engine of the symmetrical double-column or "steam hammer" type



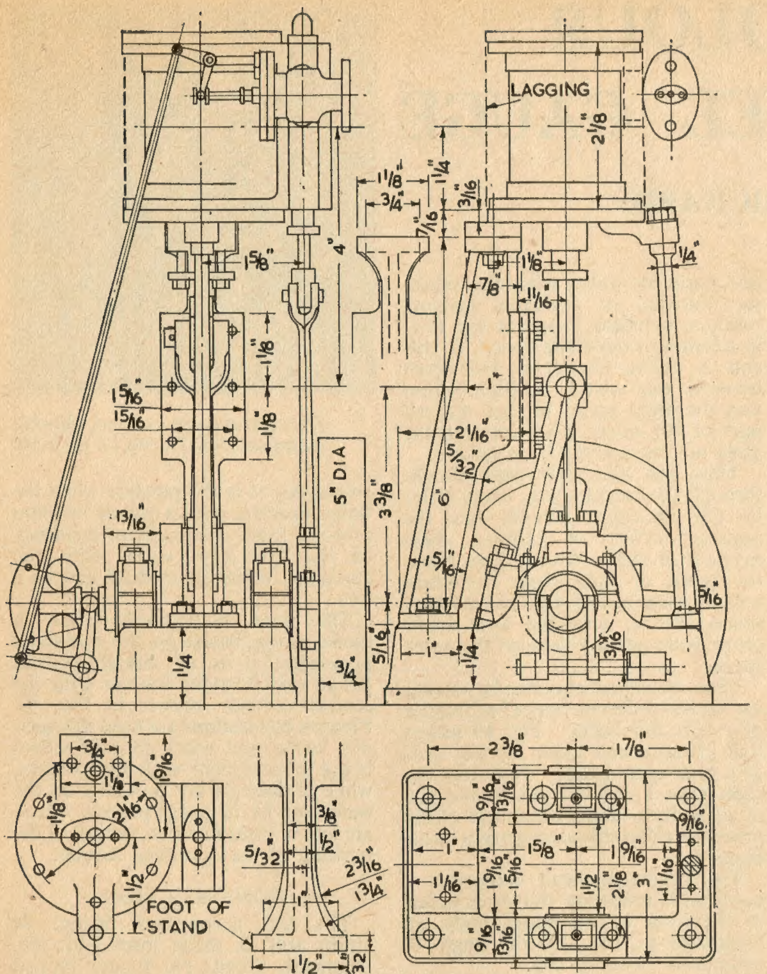


Fig. 28: A vertical engine of the single column type, with shaft governor

As the offset support of the cylinder by a single cast column leaves the structure somewhat weak to resist alternate upward and downward stresses, the opposite side is stayed by means of a single machined steel column (sometimes more than one is used) which, though light in section, has greater inherent strength than cast iron. As this is usually somewhat out of the vertical plane, both its length and the angle of its seating at both ends must be carefully adjusted to hold the cylinder assembly exactly perpendicular.

This drawing does not show the interior details of the cylinder, but these may be similar to the previous design, using either a flat slide or a piston valve. It is fitted with a governor, mounted directly on the shaft and acting on the engine throttle valve. The rather unusual position of the eccentric, immediately adjacent to the flywheel, avoids excessive projection of the shaft at the governor end. Engines similar to this have been used extensively for driving dynamos, though they were superseded by enclosed engines in later years.

Brickbat department

To those readers who, despite my explanations in the March 7 issue, have chastised me for not giving complete details with full dimensions of all these engine designs, I would like to point out that the drawings are copied as exactly as possible from Muncaster's original published designs, and this is what has been asked for by many readers over a period of several years.

The descriptive matter is my own, but if I attempt to amplify the drawings in any way their individuality will be lost; in any case, the amount of work involved and the space occupied would be out of proportion to the popular appeal, which is bound to be specialised to some extent.

The value of Muncaster's designs lies in his genius for adapting typical examples of all kinds of full-size engines to reproduction in miniature while retaining true prototype character; exact details are of lesser importance, but my previous articles on steam-engine construction should make up any deficiencies in this respect.

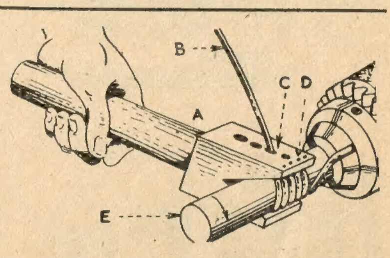
To be continued

GUIDE FOR MAKING SMALL WIRE SPRINGS

The simple arrangement shown below enables a short run of wire springs to be made without having recourse to normal spring-making machinery.

A wooden block, *A*, has a handle and several holes of different diameter, *C*, drilled through into the V-shaped opening. The wire, *B*, is then threaded through the appropriate hole, passed under a core rod, *E*, and secured in a chuck carrying the rod. The diameter of the rod is chosen to suit the internal diameter of spring required.

After making the wire taut and completing a few turns by manipulating the wooden tool, the core rod is rotated mechanically until the correct length of spring is reached. The spring is of the closed variety, but by driving a pin or nail through one of the holes, *D*, open springs can be made with spacing as desired.



The holes, *C*, will probably wear out quickly so that the wooden tool may need frequent replacement.

Digested from "A Device for Forming Small Lots of Wire Springs," in "Wire Industry," 1956 (October) page 921. The illustration is reproduced by courtesy of the publishers.

A BI-COLOUR WATER-LEVEL GAUGE

By R. D. RICHARDS

STEAM GENERATORS employing water tubes for the majority of their heat transmission surfaces have an inherently small water capacity and in consequence the water-level indicators or gauges must at all times be reliable and distinctive because of the rapid rate of evaporation and the attendant risk of running the boiler dry.

This is particularly the case where the steam drum is situated high above the firing floor level, so that in addition to an ordinary meniscus type gauge it is modern practice to fit a two-colour water level indicator, usually incorporating an arrangement of mirrors for remote visibility.

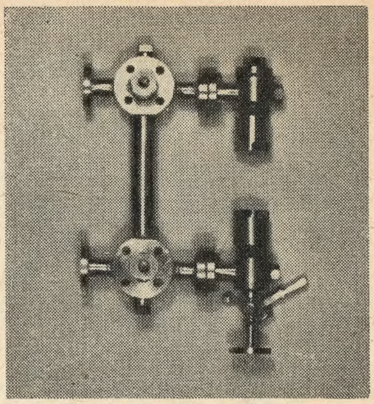
To produce a sharply contrasting division between water and steam spaces in the sight glass the selected colours are generally red for steam and green for water, while the reflecting mirrors, in periscope fashion, produce a bright image at eye level in relation to the firing floor. To this end a colour screen is interposed between the source of illumination and the sight glass, so that the red part of the screen is in line with the glass but the green part is offset.

Thus, red light rays pass straight through the steam space, while water in the indicator column has the apparent effect of bending these rays our of sight. On the other hand, the beam of light from the offset screen passes out of sight in the steam space, but is refracted and shows green when passing through the water space.

These effects are obtained by making use of the different optical properties of steam and water: Fig. 10 makes this phenomenon clear for the case of a plate-glass gauge. Note that the sight glasses are inclined to the line of sight, thus taking advantage of the prismatic effect this arrangement introduces.

The periscope head comprises a hood with reflecting mirror attached to the front of the gauge body, as illustrated in Fig. 11, the angle of inclination being 45 deg.

When tubular gauge glasses are employed, as is the practice when the boiler operates over a low or medium pressure range, the angle of incidence of the light rays varies with the curvature of the glass which acts as a lens.

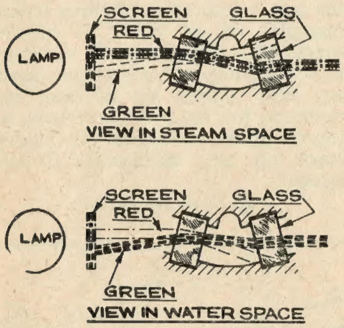


The central gauge column, showing steam and water arms on the right

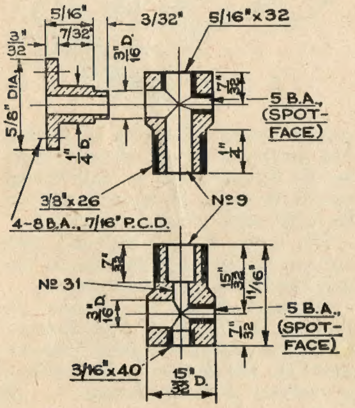
The three photographs show a model gauge based on the foregoing principles; it is of straightforward design and intended for use with the central column shown in Fig. *9. Flanged connections are used throughout, steam and water shut-off valves being incorporated with the column, while draincocks are provided on the water arm of the gauge proper. These are left or right hand according to the position of the operating handle.

CONSTRUCTION

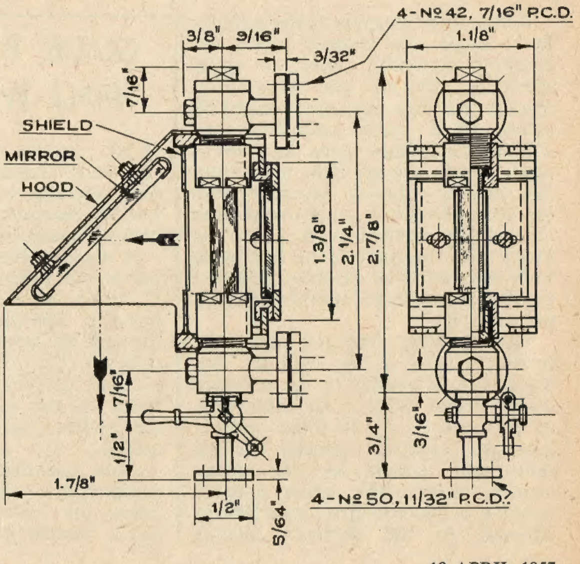
The top gauge-glass fitting, or steam arm, is made from $\frac{1}{2}$ in. dia. gunmetal, bored No 9 and tapped $\frac{5}{16}$ in. $\times$ 32 threads at the top for a



Left, Fig. 10: The refraction in a bi-colour illuminated water-gauge glass



Left, Fig. 12: The steam and water arms



Right, Fig. 11: General arrangement of a model bi-colour water-gauge

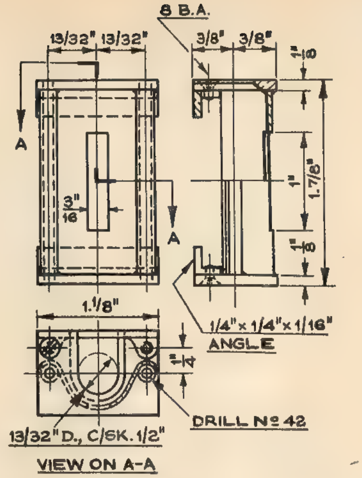
squared head closing plug provided with a $\frac{1}{2}$ in. dia. skirt (Fig. 12).

At the shoulder a 45 deg. chamfer is left when cutting the $\frac{3}{8}$ in. × 26 thread for the gland. Gunmetal gland nuts, $\frac{1}{2}$ in. dia., tapped $\frac{3}{8}$ in. × 26, have four flats filed to fit a suitable B.A. spanner size, each nut being provided with a grommet $\frac{3}{16}$ in. bore, $\frac{5}{16}$ in. dia. and 3/32 in. deep, made from rubber tubing.

A mounting flange $\frac{5}{8}$ in. dia. with integral spigot, bored No 31 and having four 8 B.A. tapped holes, is silver soldered in position as shown. Opposite to this is a cleaning plug, 5 B.A. with hexagon head, with a graphited asbestos washer. Its seating is spot-faced 7/32 in. dia.

In contrast to the top fitting, the water arm is tapped $\frac{3}{16}$ in. × 40 for the draincock, shown in detail in Figs 2, 3, 4 and 11, otherwise it is similar to the steam arm. Alignment of these two components is important, hence accuracy in mating up with the column flanges is essential if, on tightening the glands, broken glasses are to be avoided. Sufficient tension to cure leaks will be all that is required in this direction.

Fig. 13 shows the shield which serves a triple purpose by acting as a gauge-glass protector, carrier for the hood and support for the colour-screen slide to which the lamp housing is attached. Top and bottom plates are of $\frac{1}{8}$ in. brass drilled, slotted, countersunk and finished as in Fig. 13. Spacing them apart are two 3/32 in. i.d. brass tubes, also serving as tunnels for the 8 B.A. studs securing the hood, to which the plates are silver soldered. To this framework the shield proper, in 28 s.w.g. brass sheet, is soft soldered subsequent to slotting an aperture 1 in. × $\frac{3}{16}$ in. and bending to profile.



Rails formed from brass angle, $\frac{1}{4}$ in. × $\frac{1}{4}$ in. × $\frac{1}{16}$ in., are attached by two countersunk 8 B.A. screws to top and bottom shield plates and carry the slide and lamp housing; an arrangement permitting easy withdrawal or adjustment. Details are obtained from Figs 11 and 13.

COLOUR-SCREEN SLIDE

This item is fabricated from flat brass with $\frac{3}{16}$ in. channels soldered in position top and bottom. An aperture $\frac{7}{8}$ in. long × $\frac{3}{8}$ in. wide is cut symmetrically about the centre line. Although quite simple, manufacture of the two little channels may prove to be tedious by hand but is the only way out in the absence of a milling attachment.

Initially, two brass angles, $\frac{5}{16}$ in. × $\frac{5}{16}$ in. × $\frac{1}{16}$ in. and 3 in. long, are riveted together along one leg so that a $\frac{1}{16}$ in. gap is left between the other adjacent legs. This is shown at the top in Fig. 15 in dotted outline. Note that the heel of the uppermost angle is bevelled for the purpose of taking a fillet of silver solder, applied in the next operation, followed by pickling. On washing and drying, the channel may be reduced to size, as indicated by the full lines, by sawing and filing.

Next, cut the channel in half and rivet the two $1\frac{1}{2}$ in. lengths to a piece of brass $\frac{1}{16}$ in. thick so that they lie parallel, 1 in. apart, with the open ends facing outwards, then sweat the parts together. Note that each toe and heel of the channels which comes in contact with the brass plate is bevelled to take a fillet of soft solder. Finally, saw and file to the finished width of $1\frac{1}{8}$ in., thus disposing of the unwanted rivets with the surplus material. Cut the aperture and tap the six 8 B.A. holes.

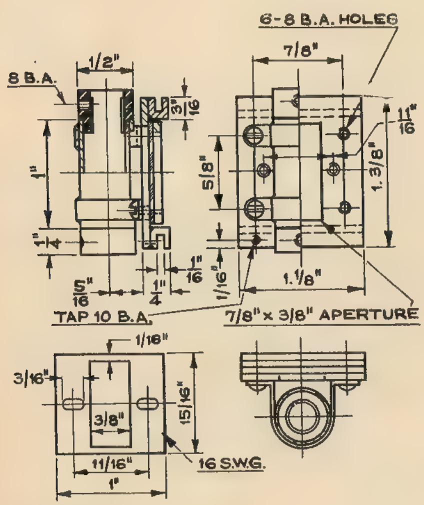
The slide is clamped in position on its rails by means of a 10 B.A. screw and the tapped hole to accommodate it may be located in any convenient position from the lamp side, as Fig. 14 shows.

A light-gauge brass tube $\frac{1}{2}$ in. outside dia., 1 in. long, is slotted and fitted with two clips for mounting purposes, soft soldered to the tube, thus forming the lamp housing. Ebonite plugs with brass shim circlips for contacts are made a push fit in the housing tube and in turn the 6 v. 3 w. festoon bulb is a push fit in the plugs. External connections to an electrical supply are made via an 8 B.A. terminal screw provided with a soldering tag and two 8 B.A. halfnuts; these items are covered by Figs 7, 8 and 14.

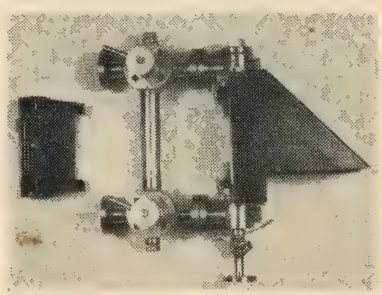
PERISCOPE HEAD

The hood is shown " in the flat " in Fig. 16. All drilling, slotting and profiling should be completed before bending, and the edges made smooth. Two tags at the top are bent downwards first, then the side and top ones. Follow this by sweating the tags to each of their respective sides. Ensure the assembly is not distorted during the sweating operation by clamping it to an improvised jig which may be a piece of mild steel. Bend up the bottom tags on assembly.

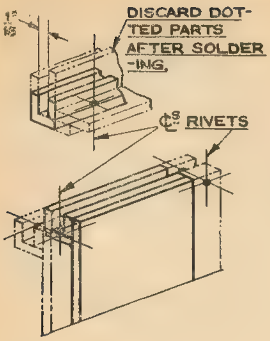
Top, Fig. 13: The front and side elevations of the shield



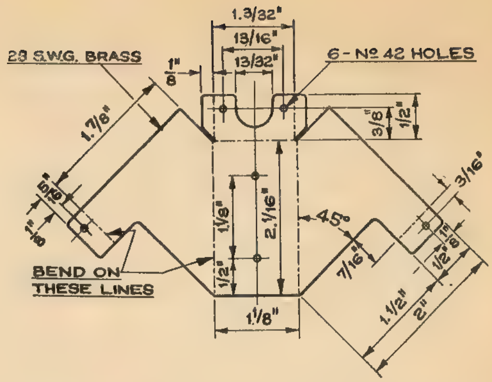
Left, Fig. 14: Details of the lamp housing and screen slide



Right: Front view of model bi-colour water-gauge mounted on central column



Left, Fig. 15: Details of channel for screen slide



Right, Fig. 16: The hood of the periscope

A colour gauge . . .

Reflecting mirrors for the periscope head and base are $1\frac{1}{2}$ in. × 1 in. The frames holding these may be 28 s.w.g. brass, the narrow ends being neatly rolled over the glass as shown in the general arrangement drawing. Soft soldered to the frame are two 8 B.A. studs with half nuts which serve to fasten this component inside the hood, two further halfnuts on the outside retaining the mirror in place. Fig. 17 shows the periscope base which stands at floor level.

Before final assembly it is advisable to colour or plate the various parts: matt black for screen slide and retaining plate and hood; bright tin for the lamp housing, shield, screws, nuts and studs. Other parts may be natural colour, tinplate or rich bronze, for which the recipes are given below.

Gauge glass of $\frac{3}{16}$ in. dia. is obtained from commercial suppliers, as is red and green transparent plastic material for the colour screens. The latter should not exceed 1/32 in.

On assembly, the unit should be tested hydraulically to about one-and-a-half times working pressure which should not exceed 100 p.s.i.

Final adjustment of the colour screen is then made with the glass half full of water and the lamp lit. This adjustment is critical in so small a size, so that a slight movement only of the screen in relation to the lamp may make a big difference to the colours in the image. For this reason the screen retaining plate is adjustable by virtue of its slotted holes which allow the screen to move relative to the slide, final adjustment being made by moving the screen in relation to the shield. Remember that rotation of the lamp in its housing may also provide a very limited amount of adjustment.

SURFACE FINISH

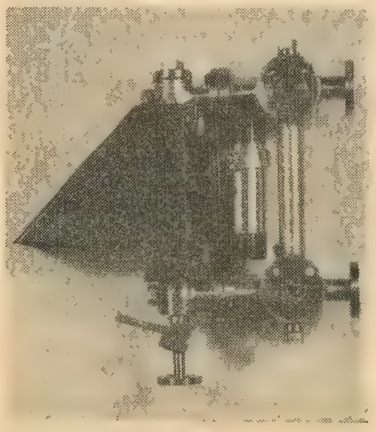
This is most important if the parts are to be coloured or plated; highly polished surfaces being essential to success.

For bright tinplating simply place the polished articles in an enamel vessel containing four ounces of granulated tin, two ounces of cream of tartar and sufficient water to ensure the parts are covered to a depth of at least an inch. Place the vessel on a stove and allow the water to boil until the desired coating is obtained; swill well in clean water and dry.

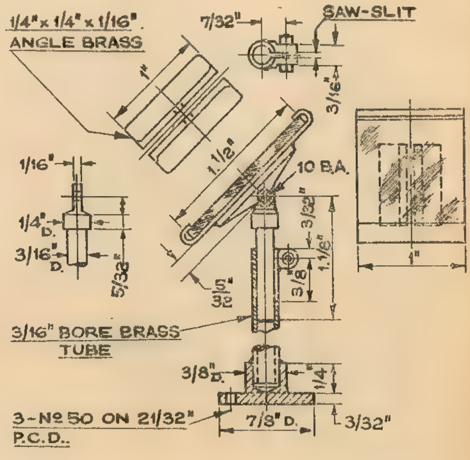
Rich bronze colour requires two ounces of photographers' hypo and two ounces of alum boiled until black in eight pints of water. The polished parts are then boiled in the solution until the desired shade of colour is achieved. Note that frothing and ebullition may occur if the heat is not carefully regulated. Wash well and dry.

For black, use two ounces of permanganate of potassium crystals and two ounces of hypo in eight pints of water, boiling until solution turns black. Immerse the articles and continue boiling until they turn a uniform black. Wash, dry, then apply a coating of liquid black lead which is brush polished after being allowed to dry.

**This article should be read in conjunction with " A High-pressure Water-gauge " by the same author which appeared in* MODEL ENGINEER *for March 21. Figs 1-9, to which Mr Richards refers, will be found in that article* ■

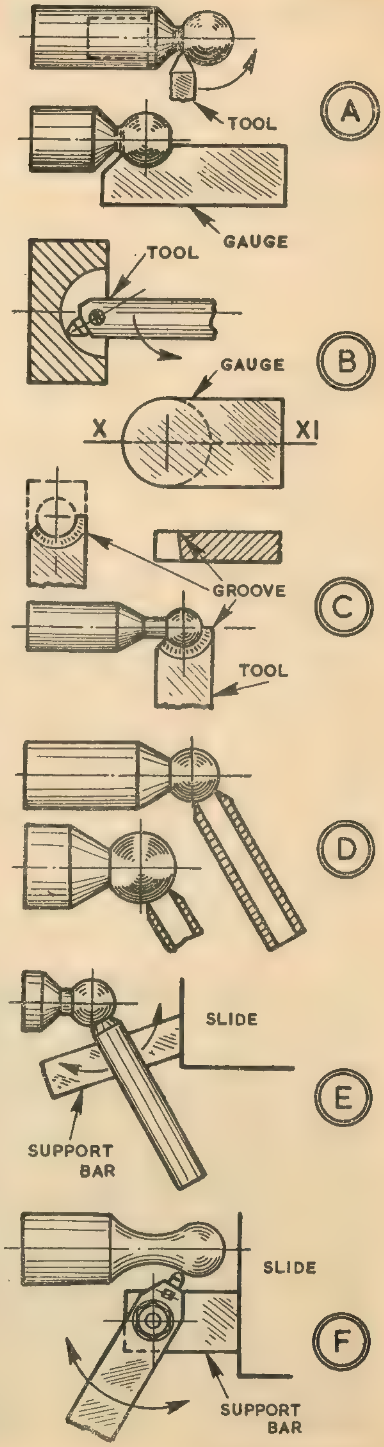


Left: A rear view of the model gauge



Right, Fig. 17: The base of the periscope

TURNING SPHERICAL RADII . . . . By Geometer



WHEN HIGH PRECISION is not essential there are several ways in which the spherical radii of ball-ended components can be machined in the lathe with the minimum of equipment.

On parts that are not required to fit others—such as ball handles or knobs—neat appearance, good finish and reasonable adherence to size are the most important features and should occasion occur, a fair degree of precision can be obtained with care even by simple methods, using gauges for checking in the course of working. Form tools can be used of course in the smaller sizes and when the numbers of components justify their production.

Although it is in the nature of an impossibility to machine a good ball-end solely by manipulation of the top and cross-slides of a lathe, familiarity with its working can greatly improve on the result that might at one time have been considered possible. For a feature like that at *A*, for example, the ball would originally be left in a "square" by turning down in the neck with a parting tool then chamfering the left side out to the full diameter.

Check with plate gauge

With a round-nosed turning tool, a start is then made on the corners of the square, the top and cross-slide handles being manipulated to swing the tool in an arc. Progress can be checked by plate gauge, made by drilling or boring a hole of required size in flat material then cutting the surplus away. When the ball has been roughed-out and shaped-up reasonably by the tool, the surface is finished by files and emery cloth.

For an internal hemisphere, as at *B*, similar principles apply—except that it is not possible to file the surface for finishing. In place of this, a round-nosed hand scraper can be used on a support bar close to the work, or a form tool can be employed for the final scraping cuts, followed by polishing with emery cloth on the end of a finger or a rounded piece of wood.

Owing to the propensity for chatter to develop on broad cuts with form tools, the depth of cut should be kept to a mere scrape, with the work revolving slowly—the chuck pulled round by hand if necessary, succeeded by high-speed polishing. Again, a plate gauge can be used for checking, the end being filed to a scribed radius, or by clamping a suitable disc to the plate if the disc is not used itself. In most instances it is unnecessary to employ a gauge of the full half-circle type as at *B*; either half to the top or bottom of *X*-*X*1 suffices.

A form tool for a ball-end is made in the manner of a plate gauge by drilling or boring a hole through material such as silver steel or cast steel, then sawing or filing the surplus away, as at *C*. Below the cutting edge the tool should be given clearance, either by careful filing or by finishing the full hole with a taper when it is bored.

Harden and temper

Hardening and tempering are essential before use; and finish on the ball is much enhanced when the tool is given top rake by carefully grinding a groove behind the cutting edge. Preparation of the work as for *A* is advisable, keeping the form tool for finishing—at a slow speed and with a flow of suds or oil. Tools of this type should be set with the cutting edge flat and at centre height.

Simple round tubular tools with true ends chamfered like those of washer punches can be used for finishing ball-ends, and will each cover a range of sizes. Round silver-steel rod faced off square, drilled up, chamfered and heat treated can be used for small tools with a support bar on the slide, as at *E*. Suitable handles should be provided, of course.

A support bar again may be used for a pivoted tool for finishing ball-ends with curved necks, as at F. ▣

The Allchin M.E. TRACTION ENGINE

W. J. HUGHES' article this time deals with the lubricator, toolbox and gear-casings

Continued from 21 February 1957, pages 285 to 289

Now for the water-lifter (Fig. 1) which, of course, is a simple type of injector. The body is turned in two halves from $\frac{3}{4}$ in. dia. bronze or gun-metal rod, the water nozzle (to which the hose attaches) being separately turned from $\frac{1}{2}$ in. dia. rod. The steam-nozzle is a separate component, pressed into the body.

Grip a stub of $\frac{3}{4}$ in. rod in the three-jaw chuck, face the end, centre, and drill right through with an 11/64 in. drill. Chamber out the rounded recess to $\frac{5}{8}$ in. dia.: I use a hand-tool for such jobs, but a round-nosed boring-tool could be used by manipulating the slide-rest handles. Counter-bore to $\frac{1}{2}$ in. dia. by 1/32 in. deep. Ream the hole to $\frac{3}{16}$ in. dia.

Turn the outside to shape, leaving very slightly over-size—here again I prefer hand-tools. Turn the flange to $\frac{11}{16}$ in. dia., and part off at a full 3/32 in. thick. Make a stub-mandrel as sketched (Fig. 2) with the spigot a tight fit for the $\frac{3}{16}$ in. hole, and press the half-body on to it. Counter-bore the top of the flange $\frac{1}{4}$ in. dia. × 1/32 in. deep, and remove from the mandrel after facing the flange.

The lower half of the body is made rather similarly, but with the following differences. After facing the end, the chambering out is done by means of a $\frac{3}{8}$ in. centre drill. Follow through with a No 31 drill and a $\frac{1}{8}$ in. reamer. Turn a spigot on the end 1/32 in. deep, the diameter being a " snap " fit in the corresponding recess in the upper half of the body.

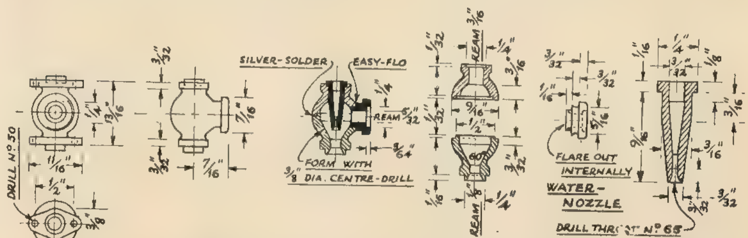
Shape the outside and turn the flange as before, but enter the parting tool to leave a spigot rather more than $\frac{1}{4}$ in. dia. Finally part off to leave this spigot a full $\frac{1}{16}$ in. long. Mount the component on a stub-mandrel, face the flange to thickness, and turn the spigot to $\frac{1}{4}$ in. dia. × $\frac{1}{16}$ in. long. Flare out the $\frac{1}{8}$ in. hole with a centre-drill to 7/32 in. dia.

Flux the joint and silver solder with No 1 solder. Pickle and wash off the job. Grip a stub of $\frac{3}{4}$ in. brass rod in the three-jaw, face and centre the end, drill No 38, and tap 5 B.A. Counter-bore to take the lower spigot of the water-lifter, and secure the latter to the mandrel with a 5 B.A. screw and washer (Fig. 3). The outside of the body may now be finished off.

Remove from the mandrel and clip the body to a small angle-plate mounted on the face-plate (Fig. 4). Set it so that the " globe " runs true, face one side off to 11/32 in. dia., centre, and drill $\frac{1}{8}$ in. dia. Unclip the work and remove the sharp edges of the hole, *inside* the body, with a curved triangular scraper.

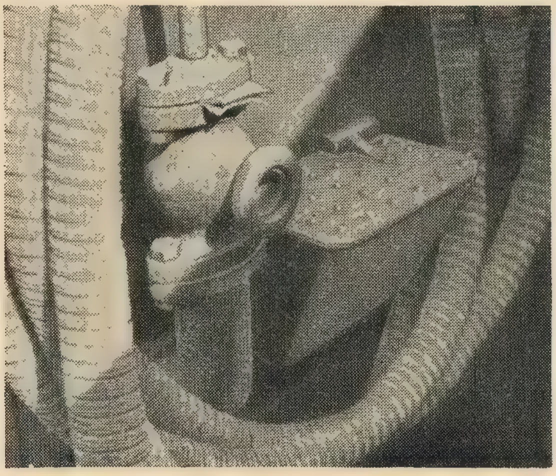
Mount a stub of $\frac{1}{2}$ in. dia. bronze rod in the three-jaw; face the end, centre, and drill No 24. Counterbore $\frac{1}{4}$ in. dia. by 3/64 in. deep, and ream 5/32 in. Turn to the shape of the water-nozzle but leave the $\frac{1}{4}$ in. spigot slightly oversize before parting off. Mount on a stub-mandrel for finishing the spigot, and for the slight flaring out. Solder the nozzle to the body with Easyflo, and clean up. Finally file the flanges to shape.

Our friend L.B.S.C. has often described the making of injector nozzles, and the reamers for same, so I do not propose to devote much



STEAM-NOZZLE (TWICE FULL SIZE)

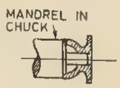
Above, Fig. 1: Arrangement and details of the water-lifter, which is made from bronze

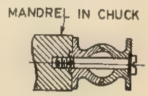


Left: The water-lifter, filling pocket and hose on the prototype engine

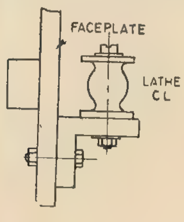
Below, left, Fig. 2: Top half on the stub-mandrel

Below, right, Fig. 3: How to hold the body for the finish-turning

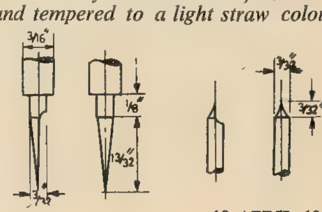




Below, Fig. 4: Mounting for facing and drilling the side of the body



Below, Fig. 5: Reamers for the steam-nozzle. They are silver steel, hardened and tempered to a light straw colour



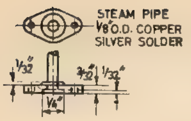
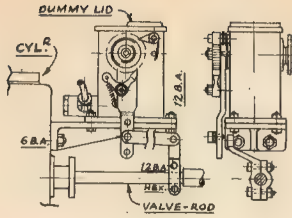


Fig. 6: Steam flange for the water-lifter



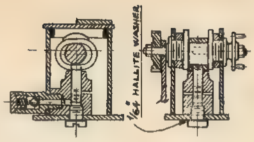


Fig. 7: The arrangement of the mechanical lubricator

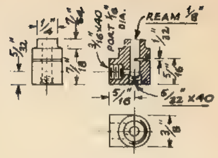


Fig. 8: The barrel for the lubricator

space to this. If the larger reamer is made with the parallel part 3/32 in. dia. by $\frac{1}{8}$ in. long, as drawn in Fig. 5, it will automatically give the correct depth to the flare, if entered until the shoulder of the reamer touches the top of the nozzle. The finished nozzle should be a tight fit in the reamed hole in the body.

The steam-flange (Fig. 6) is a simple turning and filing job, and is silver soldered direct to the end of the $\frac{1}{8}$ in. steam-pipe.

MECHANICAL LUBRICATOR

The mechanical lubricator (Fig. 7) is based on the type fitted to big sister, but is also well tried in the model world, too. In fact, I believe I am right in saying that most of the live-steam lads in the Wigan club use this type, which was first brought to my notice some years ago by their president, Mr C. H. Noble.

An eccentric works the ram by means of a stirrup. At the top of its stroke the ram uncovers a 1/32 in. wide slit through which the oil enters the barrel. Delivery is through a check-valve at the back of the lubricator, and thence by $\frac{1}{16}$ in. dia. pipe to a dummy displacement lubricator which acts as the union on top of the cylinder block.

For the barrel (Fig. 8), machine a block of bronze to $\frac{1}{2}$ in. long, $\frac{3}{8}$ in. thick, and $\frac{9}{16}$ in. tall. Set out the centre of the barrel carefully and grip it in the four-jaw with the centre running true. Take a skim off the top, centre, drill 7/64 in. and ream $\frac{1}{8}$ in. Turn the upper surface to shape at this setting, too.

The 1/32 in. slot is best cut by a slitting saw, mandrel-mounted, with the barrel fixed on the slide-rest. Remaining operations are routine jobs.

To make the stirrup into which the ram (Fig. 9) is screwed, set out and drill two $\frac{1}{8}$ in. holes, as shown in Fig. 10, on a piece of $\frac{1}{2}$ in. × $\frac{1}{4}$ in. bright mild-steel bar. Enlarge the holes to $\frac{3}{16}$ in.—this is purely to save wear on the milling cutter. Grip the bar in the machine vice, mounted on the vertical slide, and machine out the $\frac{3}{8}$ in. × $\frac{1}{8}$ in. oval slot, using a $\frac{1}{8}$ in. dia. end-mill. The surplus may be machined off top and bottom edges and a skim taken off the face at the same time.

Saw the stirrup off the end of the bar and finish by filing the outside. Drill and tap the 5 B.A. hole; the threads should be tight and dead square.

The ram itself is made from $\frac{1}{8}$ in. dia. silver steel, the shallow grooves being turned with a V-tool. (These "labyrinth" grooves act as an oil-seal, of course.) Again the threads must be dead true as well as tight; they should be cut with the die held in the tailstock holder.

To make the casing (Fig. 11) cut a strip of 18-gauge brass $1\frac{1}{16}$ in. wide, and bend it round a hardwood former planed to $\frac{13}{16}$ in. wide × $\frac{9}{16}$ in. thick. Leave the corner overlapping slightly as shown in Fig. 12. File up a piece of 16-gauge brass to $1\frac{1}{4}$ in. × $\frac{13}{16}$ in. and silver solder the two together, doing the corner joint at the same time. Pickle and clean up, filing off the surplus from the corner.

Set out the holes in the casing, and drill them with the former inserted in the body to prevent distortion under

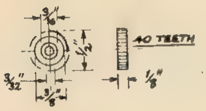
Detailed drawings for the Allchin M.E. Traction Engine are available in 13 sheets. The three latest sheets are:

Sheet 11. The arrangements and details of boiler fittings and waterpump.

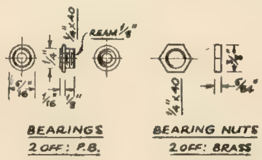
Sheet 12. The steerage, ash-pan, firegrate, water-lifter and mechanical lubricator.

Sheet 13. The footboard, toolbox, gear casings, and further details of the lubricator and arrangement of the drain-cocks.

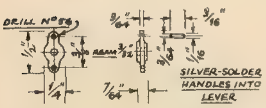
The drawings (Nos 1-8, 3s. 3d., Nos 9-13, 3s. 6d.) are obtainable from Percival Marshall Plan Service, 19-20 Noel Street, London, W.1.



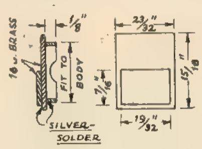
Left, Fig. 14: Ratchet wheel



Right, Fig. 15: Bearing and nuts for lubricator



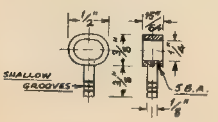
Left, Fig. 16: The hand-drive lever



Right, Fig. 17: Lubricator lid

Below, left, Fig. 9: The lubricator ram and stirrup

Below, right, Fig. 10: The commencement of stirrup



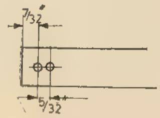
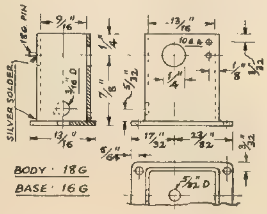
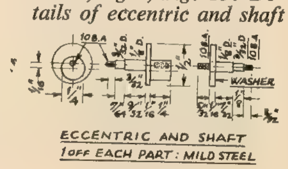


Fig. 11: Lubricator casing



Below, left, Fig. 12: Forming the lubricator casing

Below, right, Fig. 13: Details of eccentric and shaft



the pressure of drilling. The 18-gauge pin may be set in with Easyflo.

Remaining lubricator parts

All the remaining lubricator parts are more or less straightforward and need little comment. The eccentric and shaft (Fig. 13) are probably the trickiest parts, since obviously when screwed together both journals must align exactly with each other. To ensure this, after turning the outer ends of each half, use a collet (home-made as on previous occasions) to grip the ⅛ in. dia. of each in turn, while the 10 B.A. hole in the eccentric and the 10 B.A. corresponding spigot on the other half are made. Make tight threads here, too.

The eccentric itself should be turned *after* tapping the hole by setting the workpiece 1/16 in. off-centre in the four-jaw chuck.

L.B.S.C.'s methods of making ratchet wheels should be followed in

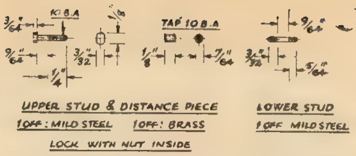


Fig. 23: Paul studs, upper and lower in mild steel, with brass distance pieces

them first, and removed after drilling, this will ensure that the clamp tightens fully on the rod.

A casting will doubtless be available for the lubricator platform (Fig. 21); this will only need to be filed up and to have the holes drilled.

DISPLACEMENT LUBRICATOR (FIG. 26)

A prominent adornment of the cylinder block of big sister is the displacement lubricator, and the oil-

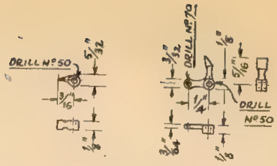
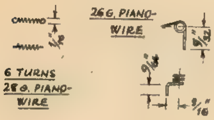


Fig. 24: Lubricator pawls

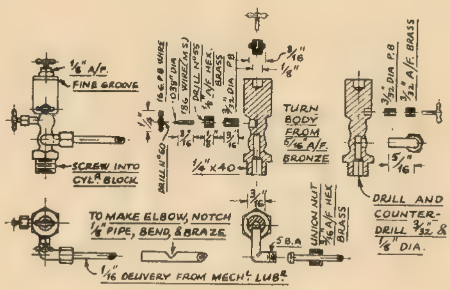
Easyflo all the joints. Tip: don't set the handles of the "cocks" all square, as drawn; they will look more realistic otherwise.

By the way, checking up recently on the fast-diminishing list of parts still to be drawn out, I noticed the lubricator for the big end of the connecting rod therein, so I include it now (Fig. 28). It is turned from hexagon bronze, 3/16 in. a/f, and neither it nor its cap needs detailed instructions. The cap should be a very nice



Above, Fig. 25: The lubricator springs

Right, Fig. 26: Arrangement and details of oil union and the dummy displacement lubricator



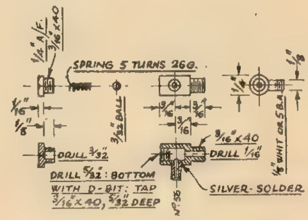


Fig. 27: Parts of the lubricator check-valve

making ours: the 3/32 in. hole should have a reamed finish to be a tight fit on the spindle. So, incidentally, should that in the hand-drive lever (Fig. 16).

The drive-lever (Fig. 18) carrying the main pawl has three positions for the drive-link stud, so that the amount of oil delivered can be varied. The other end of the link is attached to a clamp fixed to the valve rod, from which it derives its motion. This clamp (Fig. 20) is probably best filed up from the solid; the ⅛ in. hole for the valve rod should be drilled after clamping the two halves together with 12 B.A. bolts. If a piece of cartridge paper is placed between

feed from the mechanical lubricator is connected to its base. To make a working displacement lubricator for the model to reasonable scale would not be worth while, but a dummy, which will also serve as the oil union, really *is* a necessity if we are to preserve appearances.

The body is turned from hexagon bronze, 5/16 in. a/f, and the three imitation cocks are built up as shown in the drawing (Fig. 26).

To make the union elbow, use a small square file to notch a bit of ⅛ in. copper pipe, bend at right angles and braze or silver solder the joint. After cutting the 5 B.A. thread, fit all the bits and pieces together and

push fit in the lubricator, of course.

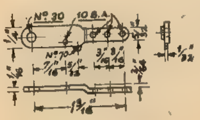
GUARDS FOR GEAR-WHEELS

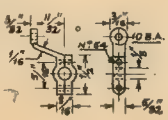
To make the gear guards of scale thickness would make them rather flimsy, and I have, therefore, shown them as much thicker but with the visible edges filed to a chamfer so that they look right. To take the second-motion guard first (Fig. 29), mark and cut out the flat sideplate from 16-gauge brass sheet.

This should be nice and flat, and to ensure its keeping flat it is best to saw it out with a fretsaw or tension-file. Finish to shape by filing, but leave 1/32 in. surplus on the outside edge where the flange is to be fitted.

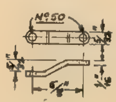
Below, left, Fig. 18: Details of the drive lever

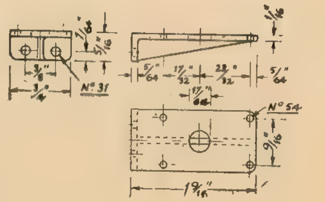
Below, right, Fig. 19: Details of the drive link





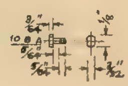
Below, Fig. 20: Valve rod clamp



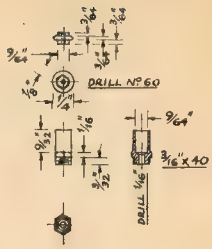


Left, Fig. 21: The lubricator platform

Below, Fig. 22: The drive studs



Right, *Fig*. 28: *Big-end lubricator and cap*



Left, *Fig*. 29: *The guard for the second motion gears*

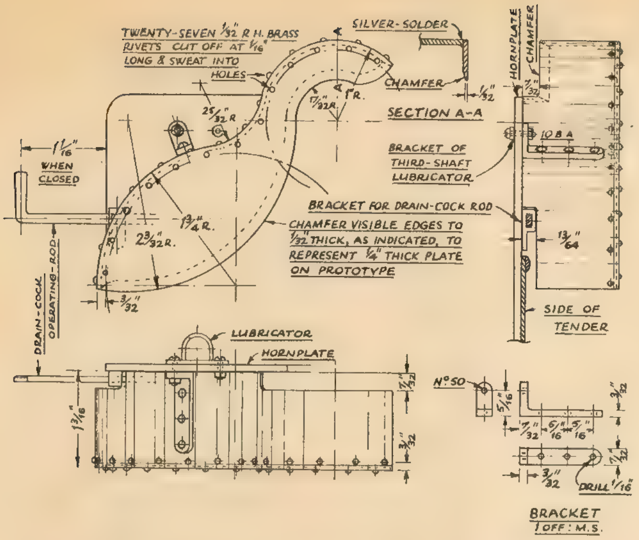
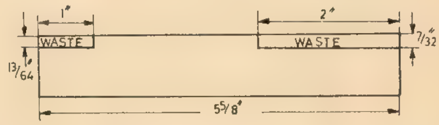


Fig. 30: *Dimensions of clearances*



The developed length of the latter is approximately $5\frac{1}{8}$ in., but it is advisable to allow $\frac{1}{16}$ in. or so at each end for possible error and adjustment. Cut and file the strip of 16-gauge brass to $1\frac{1}{8}$ in. wide and remove the two clearance strips as indicated (Fig. 30). File the chamfers on both pieces and bend the flange to shape over formers of suitable diameters.

Clean up the jointing edges and silver solder with No 1 solder. File off the overlap flush, when the joint should not be visible except for a hairlike silver line. File off any overlap at the ends, offer up to the hornplate in correct position and mark off any necessary adjustment to the two clearances. File this off also.

The guard for the final drive (Fig. 13) is made in very similar style, but because of the comparatively small clearance between flywheel and third motion the thickness of the flat plate is reduced to 18-gauge. (In any case, this guard is less vulnerable than the other, being entirely behind and protected by the hind wheel.)

Because of the developed length, the flange will be best made in two lengths with butt joints silver soldered at the same time as the main joint.

● *To be continued.*

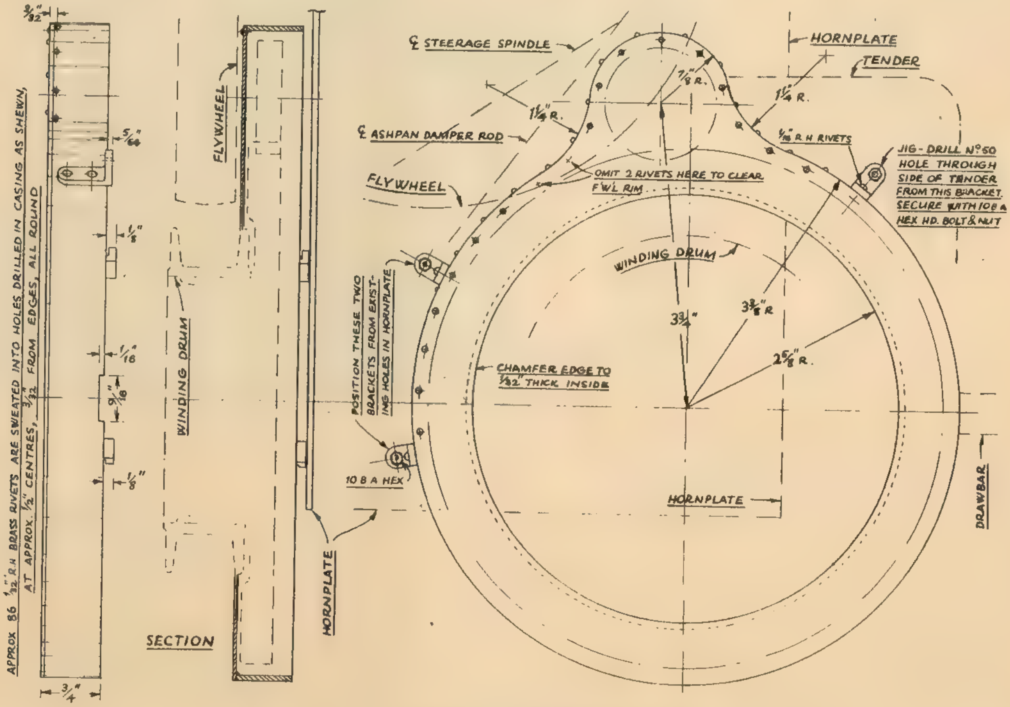
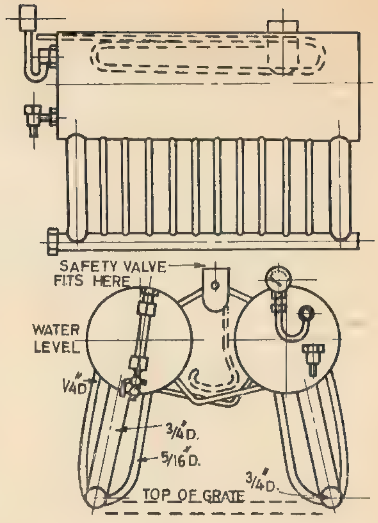


Fig. 31: *Guard for the final drive gears*

A SMALL MARINE ENGINE AND BOILER

. . . as being made by C. MAUDE, of Keighley M.E.S.



FOR those considering the possibility of building a small marine engine and boiler here is a description, with constructional details, of a water-tube type I am making.

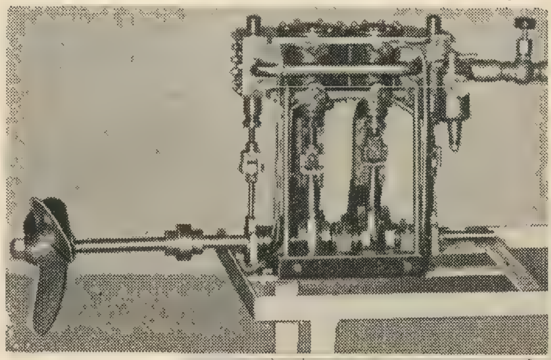
The engine needs an air pump, condenser, mechanical-lubricator for both steam oil and bearing oil (not as shown with displacement type, which is only for listing purposes), boiler feed-water and circulation and bilge pumps. The reversing gear, however, is almost complete and ready for fitting to the engine.

The engine is a compound with $\frac{3}{4}$ in. × $\frac{3}{4}$ in. h.p. and $1\frac{1}{4}$ in. × $\frac{3}{4}$ in. l.p. cylinders. The crankshaft weights are solid with the shaft and oilways drilled to the big-ends from two outside main bearings.

The propeller is a 4 in. o.d. gunmetal cast from my own patterns, as are the engine castings (in cast iron).

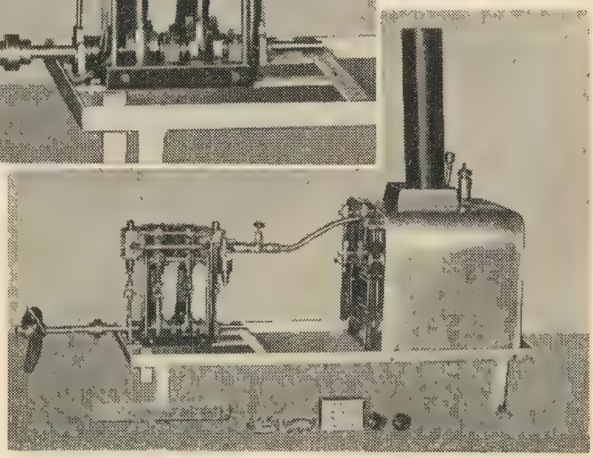
This little engine, running on test, has held a load of $9\frac{1}{2}$ lb. on $\frac{1}{8}$ in. cord running in an 8 in. groove turned in a 3 in. flywheel, on 60 lb. p.s.i. steam (no superheat). Not until the plant was shut down was it noticed that the engine had been running the wrong way, and that all the pull had been taken at the anchorage of the cord. The h.p. was never worked out and is still not known, but I am still nevertheless satisfied with what occurred.

Now the boiler: this, as shown, is a second attempt. Originally, it was Scottish marine return tube 7 in. dia. × 7 in. long, firebox $4\frac{1}{2}$ in. long × $3\frac{1}{2}$ in. dia. This boiler was a good looker, but was very temperamental; the fire required too much forced draught and burned too fiercely and soon wanted replenishing. Then,



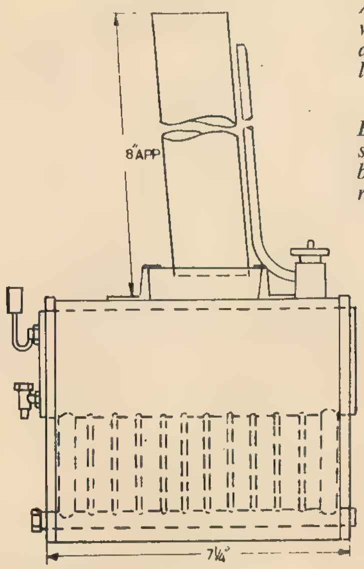
Above: Front and side elevation of the boiler with the casing removed

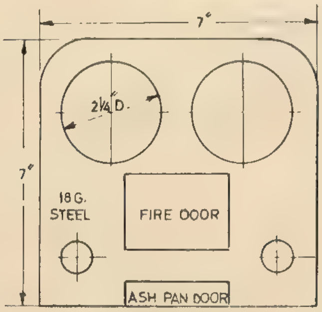
Bottom: Method of lagging by asbestos sheet and wool

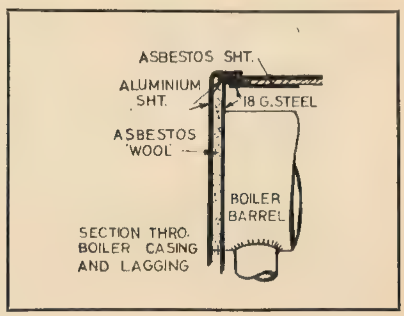


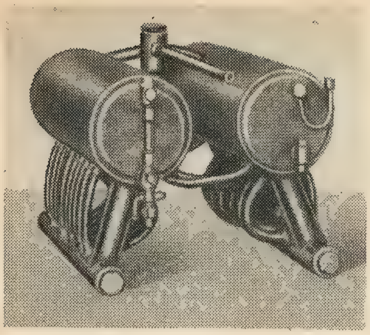
Above: The engine with the twin cylinders mounted and, lower, the complete set-up

Below: Front and side elevation of the boiler and the arrangement of the fire tubes









Twin-drum water-tube boiler

with new fuel, it would nearly go out. This naturally caused great fluctuation in steam pressure. Thus it was unsuitable for a boat.

Now I have a twin-drum water-tube type with 7 in. long drums × 2¾ in. o.d., four down comers and four banks of 10 tubes each (see picture). The grate is 6½ in. × 4½ in. and the total depth of fire can be up 2½ in. thick. These are two steam pick-ups to centre manifold, a safety valve and to keep the water level equal in each, six balancer tubes lead from one drum to the other.

Superheat to a small degree is carried out by approximately 18 in. of ¼ in. copper tube in the boiler case.

Fuel can be dropped down the funnel ; this saves having to remove the deck fittings, etc., every time.

Casing of boiler is 18-gauge steel sheet, protected inside by fire clay on cement and over the top of the steel case is a layer of asbestos with a final skin of aluminium. The end covers are also of aluminium with soft boiler lagging put in between.

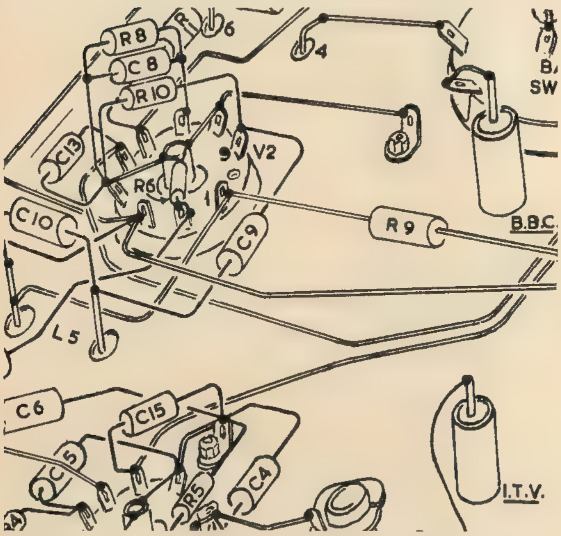
The ashpan is not yet installed. It will have to fit the shape of the hull in the bottom and be able to withdraw complete with ashes for cleaning.

By having such a large firebox I find that I can get all the steam I require with natural draught and a nice red fire. It does not need refuelling too often—which is a good point. In addition, ordinary household coal can be used to good effect. And, as a touch of realism, I get plenty of lovely smoke!

The rig, as shown now, is for testing the plant on completion. The idea is to fit a large biscuit tin near the end, pushing the propeller shaft through and then replacing the propeller on inside. Then I shall fill up with water and observe what results under load before installing in the boat. The weight, in running trim is now 28 lb. I expect it to go up to 34 lb. when the engine is complete. ■

MAKING A QUALITY TV CONVERTER

A special article for those interested in the television field



This diagram is a section of the complete layout and gives some idea of the clarity of the working drawings

READERS will be interested in one of the most compact and efficient Band 3 converters yet made . . . it will be described fully in the current issue of *Home Mechanics.*

It has been designed especially for construction by the amateur engineer and affords ample scope for the exercise of that skill and patience which has produced in the past so many fine examples of model engineering.

Following usual practice in engineering, working drawings and diagrams have been included and, if required, these may be obtained separately to avoid cutting the magazine. This converter is suitable for the reception of the I.T.V. programme in the outer fringe of reception, or in districts where Band 3 is not easy to receive. A converter using the circuit and components described receives successfully the Croydon transmissions at Bedford, a distance of 55 miles.

This outstanding sensitivity is obtained by using a cathode connected twin triode followed by a triode pentode valve, which gives the equivalent of four separate valves. The first valve has a neutralising network with H.F. compensation, giving considerable signal gain at the Band 3 frequencies. Further amplification takes place in the pentode section of the second valve. Here the signal is electronically mixed with the oscillations of the local oscillator which forms the second part of the second valve.

The intermediate frequency output obtained by mixing the amplified incoming signal with that produced locally is developed across the primary of the output transformer. The secondary is suitable for a balanced or unbalanced input so that either type of television receiver input may be used.

Owing to the very compact nature of the converter, which is essential where V.H.F. signals are used, particular care has been given to ensuring that the wiring details are as clear as possible.

● *" Home Mechanics " is available from all newsagents and bookstalls, price 1s. 3d. A plan of the converter is obtainable from Pervical Marshall and Co. Ltd, price 3s., postage 3d. Please send order to Plans Service, 19-20 Noel Street, London, W.1, quoting reference G.2.* ■

A SIMPLE PROTOTYPE FOR BEGINNERS

M. A. HARRISON suggests a method for building fairly large-scale locomotives to operate on restricted tracks

ENTHUSIASTIC beginners often want to turn their hand to the production of a fairly large-scale, passenger-hauling engine. They may think they are too ambitious and are wanting to run before they can walk, and in this they may be right.

Then again, they may be quite confident in their ability to turn out a fairly good passenger-hauling engine but find that space does not permit their building such a machine, so they build only the smaller gauges. And building locomotives for the smaller gauges has often caused a beginner to give up before he has really started, for it may be very likely that the novice has some difficulty in finishing minute component parts.

I do not mean to imply that a beginner should *not* try to build for the small gauges, but should he feel like building an engine to haul him along the iron road, and he has space to lay a $3\frac{1}{2}$ in. gauge track, then he can fulfil his ambition by building a narrow-gauge engine to a large scale and laying his track to suit (e.g. he could lay it down as a 4 in. gauge road for 2 in. to 1 ft scale).

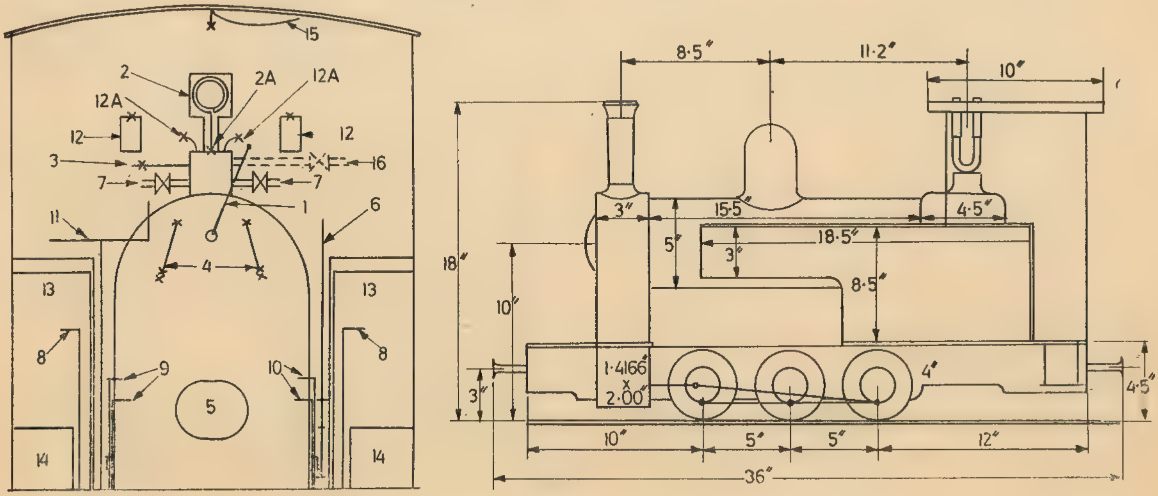
The accompanying photograph (for which I am indebted to The Yorkshire Engine Co., Sheffield) shows an ideal engine as a prototype for beginners. This 2 ft gauge, 0-6-0 tank engine was built for the United Provinces Provincial Public Works Department of India in 1915, and as it was required for construction work where it was not likely to be given the best maintenance, its design was both robust and simple, while the power output was high for its weight and size.

This machine had cylinders $8\frac{1}{2}$ in. dia. and 12 in. piston stroke, coupled wheels were 2 ft dia. and the rigid wheel base was 5 ft; short enough to enable the engine to negotiate curves of very short radius as are always found on construction tracks. Its tractive effort, at 85 per cent. boiler pressure, was 4,920 lb. The working pressure was 160 p.s.i.

If a model of this engine were built to a scale of 2 in. to 1 ft, as I have suggested, the beginner would have a massive model which, though really powerful, could run on a fairly rough track, would be simple to build and easy to maintain, and at the same time would lend itself to modification should the builder be keen on free-lancing.

Copied as it is illustrated, the engine

Rough line diagram of 2 *ft gauge* 0-6-0 *tank engine based on the accompanying photograph and dimensioned for a scale of* 2 *in. to* 1 *ft. Key to diagram*: 1. *regulator handle*; 2 *and* 2*A. steam-pressure gauge and cock*; 3. *blower steam-valve*; 4. *water-gauge glasses*; 5. *firehole door*; 6. *reversing lever*; 7. *injector steam-valves*; 8. *injector water-valves*; 9. *damper levers*; 10. *sanding levers*; 11. *screw brake handle*; 12 *and* 12*A. displacement lubricators and cocks*; 13. *toolboxes*; 14. *coal chutes*; 15. *whistle cord*; *and* 16. *steam-brake valve*



would work on a 4 in. gauge track, it would have cylinders 1.416 in. × 2 in. and its rigid wheelbase of 10 in. could traverse sharp curves if the intermediate pair of wheels were flangeless. The width of the model would, if the prototype was copied, be 12 in. and its height from rail level to the top of the chimney and to the tops of the safety valve tubes would be 18 in.

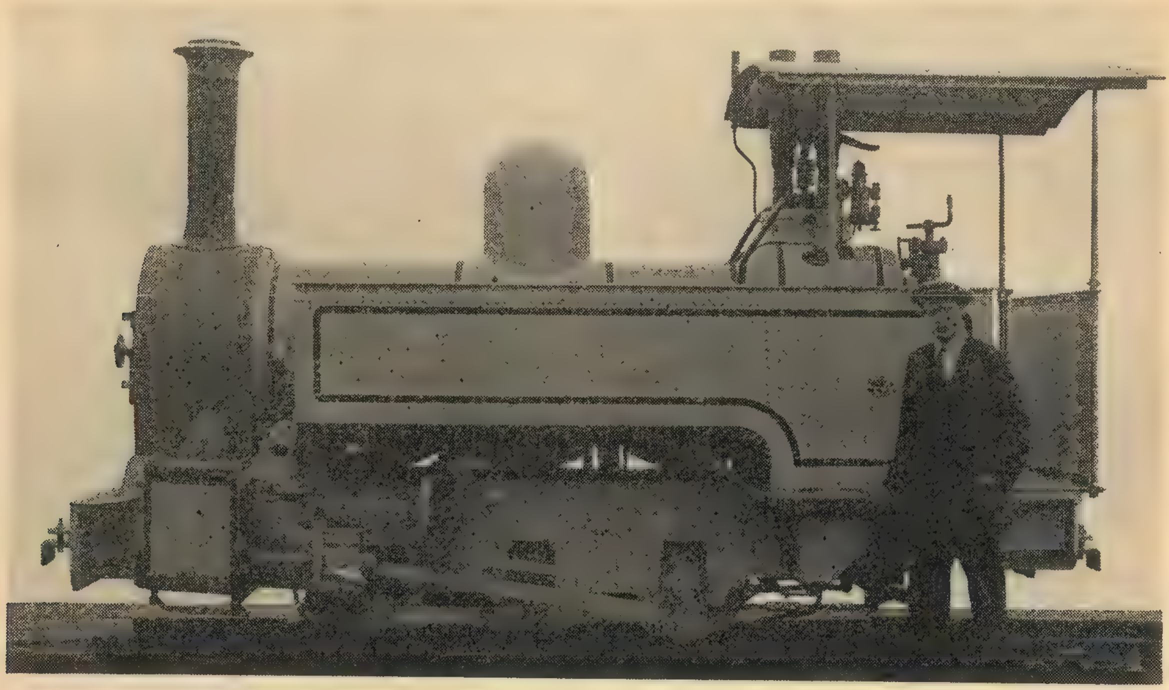
As regards the various component parts, the boiler would be large enough to be a straightforward job. The Walschaerts valve gear used on

rods, slidebars, motion pins and crankpins would, as on the prototype, be by oil cups, while two displacement lubricators could be fitted, one to feed each slide-valve and piston. Cab fittings would be the lubricators just mentioned, steam-pressure gauge, whistle cord, two water-gauge glasses, regulator handle, two steam-valves for separate injectors (no feed pump is employed), blower valve, handles for front and rear sand boxes and damper doors, and screw brake handle.

Coal bunkers are provided on either side of the cab, that on the right-hand

would enable leading and trailing bissel trucks to be fitted and the coal bunker could then be enlarged and carried behind the cab, which could be provided with spectacle plates and sides.

This would enable the designer to fit larger water tanks or, should he wish to do so, he could remove the tanks and bunker altogether and build a very neat tender engine of the 0-6-0, 2-6-0 or 2-4-2 type, while the fitting of such details as foot-plating, handrails, etc., would really make the model. ■



2 *ft gauge* 0-6-0 *tank built for the United Provinces Provincial Public Works Department*

the prototype is not complicated, nor are the coupling and connecting rods. A single slidebar is used, this being bolted to the rear cylinder cover and to a simple motion bracket. A D-slide valve is employed for steam distribution, the steam-chest being covered by a simple plate retained by studs and nuts.

Main frames are the simplest of plates, which could be cut out as a pair; these are outside the wheels, which are very simple ones, being disc-type with quadrant-shaped balance weights. Axle boxes on this model would afford no difficulty to the beginner, nor would the horn cheeks, while the large scale would permit the use of true-to-type springs.

Lubrication of valve spindles, piston

side being outside the reversing lever which, however, does not come in the way of the fireman's shovel.

I have given an outline of the engine for the beginner, but there may be the advanced builder who is interested in little engines and looks for all the minute details which are found on narrow-gauge locomotives. A close examination of the accompanying photograph will certainly gladden the heart of any such an enthusiast!

I have mentioned the freelance builder who may want to change the existing design. For him I will say that a little thought will show that the prototype will lend itself to quite considerable modification; for instance, lengthening the frame plates and extending them fore and aft

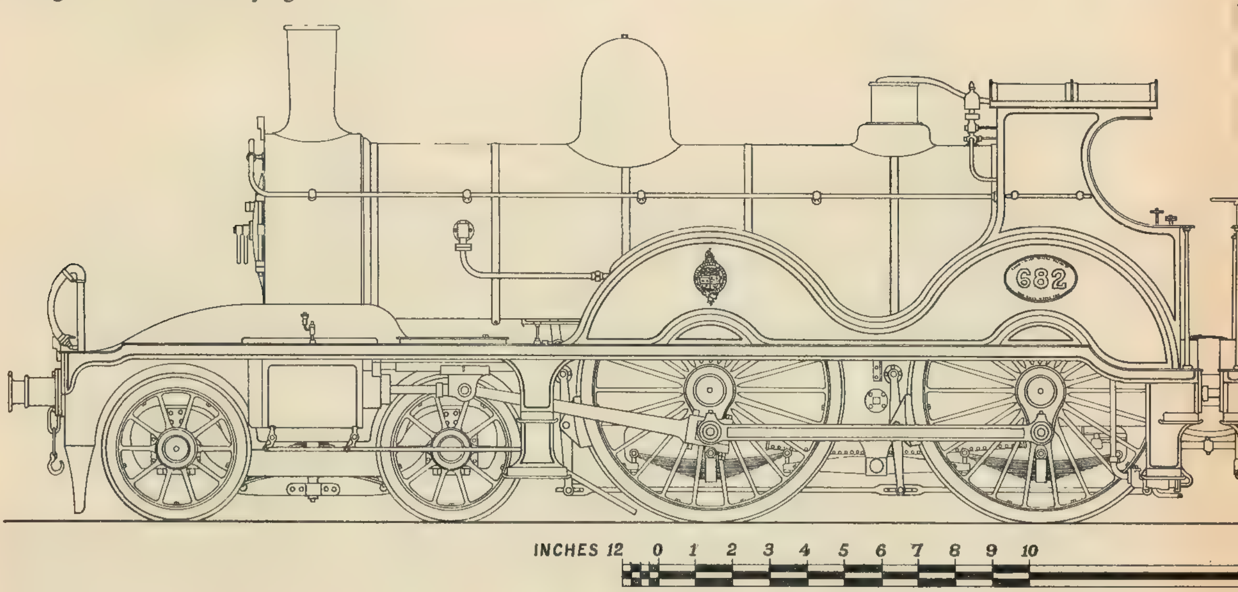
LOCOMOTIVES I HAVE KNOWN

No 31 By J. N. MASKELYNE

London and South West

WILLIAM ADAMS of the London and South Western Railway was a strong advocate of the 4-4-0 type passenger locomotive, and designed several series of such engines.

His usual custom was to have these engines built in two series at a time, one with 6 ft 7 in. driving-wheels for working over the heavily graded routes west of Salisbury, and the other with 7 ft 1 in. driving-wheels for working east of that town.



This custom began in 1883 and it terminated, so far as the Adams engines were concerned, in 1896 with the building of Classes T-6 and X-6. Engine No 682 was one of the T-6 class which, to my mind, were the finest of all the Adams engines. They were designed on the massive scale; their proportions were excellent and they were very solidly built. On the road they were speedy and powerful, and they well-merited their nickname of Adams Flyers.

There were 10 of them, and when I first came to know them they were about four years old; they were numbered 677 to 686, and I think they were all stationed at Nine Elms.

If my recollection is accurate, No 682 was the only one of the 10 still in the original Adams livery; all the others had been repainted in the style introduced by Dugald Drummond. In fact, I believe that the last four engines of this class, dating from March and May 1896, were painted in Drummond's livery when they were new.

I have shown No 682 in the Adams style because she was like that when I first knew her, and I copied it from her official photograph. It was plain, neat and simple, and I rather preferred it to the Drummond livery.

However, no matter what the livery, in the T-6 class, Adams produced some really grand 4-4-0 express passenger engines that could hold their own against any others of their type and period; and they remained unchallenged on their home road until Drummond's celebrated T-9 class appeared in 1899.

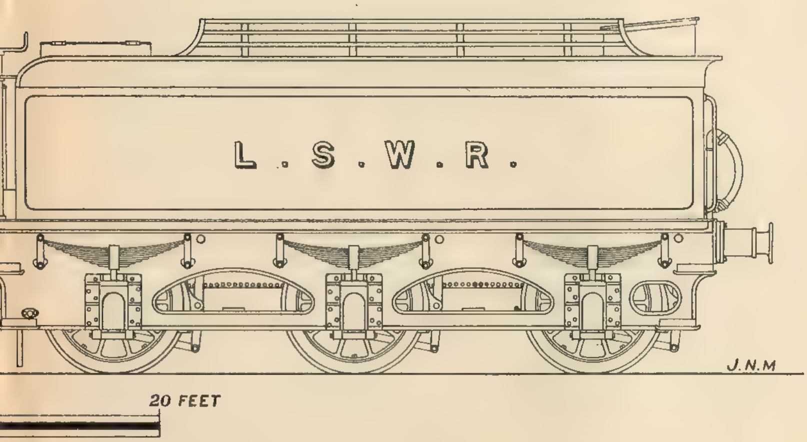
Compared with the earlier Adams 4-4-0 engines, the T-6 class had slightly longer smokeboxes and fireboxes, the latter necessitating a 6 in. addition to the coupled wheelbase. These slight alterations, however, considerably enhanced the appearance and gave the engines an air of noble dignity that the earlier engines did not quite reach.

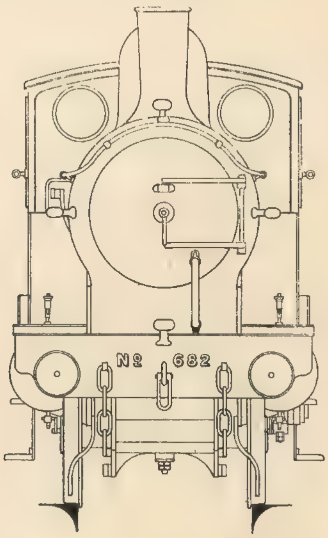
The opportunity was taken to introduce a cast-iron stovepipe chimney with a perfectly smooth exterior, which added its quota to the generally pleasing effect of the other modifications.

The principal dimensions were: cylinders, 19 in. dia., 26 in. stroke; wheels, bogie 3 ft 9$\frac{3}{4}$ in., coupled 7 ft 1 in. dia.; wheelbase, 23 ft 6 in. divided into 7 ft 6 in. plus 7 ft plus 9 ft; overhang 3 ft 1 in. at the front, 4 ft 3 in. at the back.

The centre-line of the boiler was pitched 7 ft 9 in. above rail level, and the height to the top of the chimney

ern Railway ‘T-6’ Class





was 13 ft 2¾ in. The diameter of the barrel was 4 ft 4 in. and its length was 11 ft; it contained 220 tubes of 1¾ in. dia., the heating surface of which was 1,141.7 sq. ft. To this, the firebox added 122.1 sq. ft, making the total heating surface 1,263.8 sq. ft. The grate area was 19.65 sq. ft, the outside length of the firebox being 6 ft 10 in.

The tender, carried on six 3 ft 9¾ in. wheels, had a wheelbase of 13 ft equally divided and the total wheelbase of engine and tender was 45 ft ⅛ in.; at least, that is the official figure, and I have often wondered if it remained constant and unaltered when the engine was pulling !

In any case, I have been unable to discover what accounted for that odd ⅛ in. There must have been something somewhere, because the total length of engine and tender over buffers is given as 54 ft 5⅜ in. With 5 tons of coal and 3,300 gallons of water, the tender weighed 33 tons 4 cwt. Incidentally, it was on these engines that tender coal rails made their first appearance on the L.S.W.R.

The engine weighed 50 tons 2½ cwt, so that, ready for the road, engine and tender scaled 83 tons 6½ cwt. The working pressure was 175 p.s.i., which was common to all the later Adams 4-4-0 engines. An official figure for the tractive effort does not appear to have been published.

For several years these fine engines worked the best expresses between London and Southampton, Bournemouth and Salisbury; they were seldom to be seen at Exeter, Plymouth or other places west of Salisbury.

Only one of this class, No 680, was ever fitted with a Drummond boiler, but in later years the Drummond chimney appeared on most of them; No 684, however, retained the Adams chimney until she was withdrawn in 1940. The withdrawal of these fine engines began with Nos 677 and 683 in 1933; Nos 678, 682, 685 and 686 followed in 1936; Nos 679 and 680 in 1937; 684 in 1940, and No 681 in 1943.

The last-mentioned gave me a pleasant surprise one afternoon in 1937; I happened to be on Wimbledon station when she came through at a good 65 m.p.h. at the head of the up Atlantic Coast Express, about 20 min. late. For that, I thought she deserved all honour in her old age; but it showed the stuff that was in her.

I cannot think of many other engines which, at the age of 42 years, would tackle a train like that, non-stop from Salisbury to Waterloo. I can only suppose that the King Arthur or Nelson that should have worked the turn had failed, and No 681 was the only substitute available. But what a contrast.

Later, I discovered that she had worked down to Salisbury on a local train from Basingstoke, her home station, and was preparing to work a similar train back when she was suddenly called upon to work the A.C.E. to London instead. It was an all the more meritorious performance when we remember that the water capacity of her tender was only 3,300 gallons; and there are no water troughs on the line, or ever have been.

In the last years of this class, No 686 was always conspicuous because the brass beading on her splashers had never been removed, or painted over, and it was kept brightly polished. I never discovered the reason for this but feel that there must have been one simply because most other Adams engines had had the beading removed during Drummond’s régime; those that had not had it removed had had it painted over.

Finally, I would suggest that, even at this late date, an Adams T-6 would make a fine model, especially in 5 in. or 7¼ in. gauge. Many years ago, models of Adams 4-4-0 engines were fairly numerous; but curiously enough never a T-6, and I have often wondered why. To be frank, however, most of those models were hideous and entirely unnecessary caricatures of Adams’ beautiful designs, and I have been told that, because of this, William Adams regarded model locomotive builders as lunatics !

When, in the late 1890s, the two Coates brothers approached him for information to enable them to build a model of one of the X-6 4-4-0s, he at first refused to have anything to do with them. But Messrs Coates persisted and sent him examples of their previous work; then he relented and gave them the particulars they wanted. The result was the superb model that is to be seen and admired in the Science Museum, South Kensington. ■

VIRGINIA

Continued from 11 April 1957, pages 536 to 538

This article concludes L.B.S.C.'s instructions for building the interesting old-time 3½ in. American engine

LITTLE MORE REMAINS to be done to complete the job. I mentioned last week that the brake gear described for the smaller tender could be applied to the larger more modern one, and the only variation needed would be in the position of the brake column. This is fitted in the same way, through a hole drilled in the soleplate at 1⅜ in. off the centre-line, but it will have to be set nearer to the front of the tender as there is no coal recess and the tank extends almost the full length of the tender body.

Drill the hole about ½ in. ahead of the front plate, which will allow for the easy operation of the brake handle. Don't forget that the handle only has one end turned up.

The brake-shaft assembly is fitted in the same way, being located at the bottom of the brake spindle, and the same method of getting the length of the leading pull-rod is used; but turn the shaft a complete half-turn so that the arm to which the pull-rod is attached hangs down and the actuating arms point forward. This will allow the assembly to be fitted behind the centre line of the brake spindle, and will give more room for the job.

If the feed pipes get in the way, bend them to clear; the pull-rod can also be set up a little if it runs foul of the bottom of the leading bolster. Anyone wishing to set the brake column nearer to the side of the tender can easily do so by lengthening the brake shaft and bracket to suit; put it any place you fancy, provided the pull-rod arm is kept on the centre line of the tender. If it isn't, there will be trouble on curves. In the central position, the flexibility of the rods allows for truck movement.

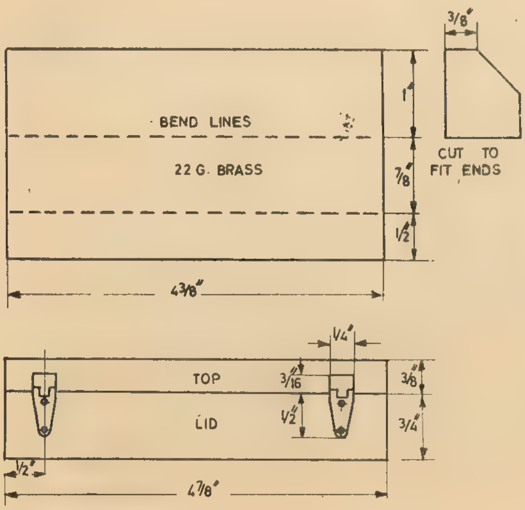
TOOLBOX

The front, bottom and back of the toolbox can be made from a single piece of thin brass, about 22-gauge, measuring 4⅜ in. × 2⅜ in. Mark this out as shown, and bend on the dotted lines. The sides are cut from the same kind of material, soldered in flush with the ends. The top is another strip, ⅜ in. wide, which should overlap the box at each end by 1/32 in. This can be soldered in place.

The lid is the same length, but ¾ in. wide, and it is attached by two little hinges, which should be small and neat. The way I made those on my L.B. and S.C.R. *Grosvenor* was to cut two pieces of very thin brass to the width desired and bend them around a blanket pin, so that when viewed endwise they looked like very thin split-pins (see illustration) They were squeezed up very tightly in the bench vice, so that the heads were as near circular as possible.

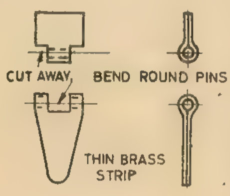
As they had several serrations, I cut them with a small milling-cutter; but those for *Virginia* are of the tongue-and-slot pattern, so all that is necessary is to file away the dotted parts to form the tongue and slot. The longer piece is filed to the shape shown and can be either riveted to the lid or soldered; the same applies to the shorter piece. The hinge-pin is a piece of wire of the same thickness as was used for forming the hinges.

Drill a couple of holes in the bottom of the box with a No 41 drill, place in position at the back of the tender, run the drill through the holes and make countersinks on the soleplate, follow with No 48 drill right through, tap 3/32 in. or 3/48 and put a couple of screws in, which will hold the box securely. Keep a couple of 5/32 in. split-pins in it; then if you drop one in the long grass when coupling engine and tender on the club track it will save a time-wasting search !



Left: Details of the toolbox

Below: How the hinges are made



TENDER STEPS

Some of the old full-size engines had wooden steps—they seemed to be mighty fond of wood construction in days of old—but they wouldn't be much use in 3½ in. gauge.

The treads are made from 13-gauge steel, the upper steps being ⅜ in. wide and the lower ½ in. wide; all are ⅞ in. long. The outer ends are rounded off. The supports are made from strips of 3/32 in. steel a full ⅛ in. wide.

The easiest way to assemble steps and supports is to braze them; and I expect beginners will wonder how on earth they are going to get the steps to stay in place while the brazing job is under way. Well, there are tricks in every trade.

All that is required is a simple jig for holding the steps. A short bit of ⅛ in. × ½ in. steel would do fine. File or mill two 3/32 in. slots in it at 1 in. centres, one a little deeper than the other, jam the step-treads into the slots with the squared edges outwards and level with each other, and lay them in place on the supports. These can be taught good manners by laying them parallel at the right distance apart on a piece of asbestos, and putting pins at each end to prevent side movement.

Apply some wet flux, heat the lot to bright red and touch the joints with a bit of soft brass wire about 16-gauge, or a $\frac{1}{16}$ in. Sifbronze rod. Let it form a little fillet between tread and support. Quench in cold water when the redness has gone and trim with a file if necessary, after pulling off the jig.

The supports are attached to the frame sill, close to the front end, as shown in the general arrangement drawing of the tender. The rear one can be screwed direct, but the front one will come just where the curved part begins and the support will have to be twisted a little to make it bed nicely against the sill.

In a drawing of a full-size tender of this type, which I have here at the present minute, the front support not only has a twist in it but two offsets as well. I should say that the craftsman who forged up that merchant was certainly some blacksmith—and I'd dearly love to know what he said about the draughtsman responsible while he was doing the job !

The modern type of tender can be furnished with the ordinary type of steps made from 16-gauge steel sheet, the bottom tread being bent at right angles in one piece with the back support. The upper step can be riveted to the back, or brazed, as desired. The dimensions are the same as the old-fashioned pattern shown, so no separate drawing should be necessary. Alternatively, the step-ladder pattern can be used, both rungs and sides being made from 16-gauge steel with brazed joints.

The sides should be the same length as the old ones shown, and a full $\frac{1}{8}$ in. wide. The holes for the rungs should be drilled No 52 at $\frac{1}{2}$ in. centres, starting at $\frac{1}{16}$ in. from the bottom, and the rungs (of 16-gauge spoke wire) cut to about $\frac{5}{8}$ in. and pushed through, the sides being set at $\frac{1}{2}$ in. apart. Braze the rungs where they project through on the outsides of the supports and file the projections flush with the sides. This process makes neat little ladders.

COUPLING OR DRAWBAR

The drawbar between engine and tender can be filed up from a piece of $\frac{1}{2}$ in. × $\frac{1}{8}$ in. mild steel to the size and shape shown. The engine end is drilled $\frac{1}{4}$ in. clearing, and attached to the bracket screwed to the drag beam by a turned bolt made from $\frac{3}{8}$ in. hexagon steel rod. The screwed part of this is $\frac{1}{4}$ in. long and is threaded 5/32 in. × 40, a nut to suit being made from the same material. I have shown it inserted from the underside as it can easily be inserted that way without disturbing anything, and as long as the threads are fairly tight it stands no chance of coming adrift.

The nut takes no strain but merely prevents the pin from coming out; the pin itself takes the pull. However, anybody who wants to put it in from the top can do so by drilling a hole in the cab deck just big enough to let the bolt-head go through; it can be located by putting a $\frac{1}{4}$ in. drill through the hole in the bracket from underneath and drilling up through the deck, afterwards enlarging to the correct size from above.

The tender end of the drawbar fits in the slot in the bracket which is attached to the front end of the tender frame and is secured by a commercial 5/32 in. split-pin for reasons mentioned earlier; but there is no objection to the use of a turned pin by those who like to take the trouble to turn it ! The turned pin won't do the job any better, though.

Current for the electric headlight

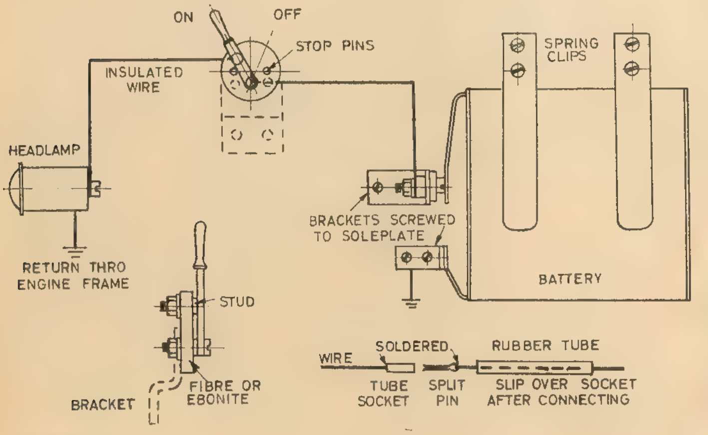
I promised to show how the electric headlight specified for the modernised *Virginia* could be supplied with "juice," and here is a diagram showing a simple arrangement utilising an ordinary torch battery of the flat pattern. These have three cells and are rated at 4½ v. The bulb in the "pencil" torch will probably be only 2½ v., so it will have to be changed to suit the battery unless a large battery of the two-cell type, such as a cycle-lamp battery, is utilised. This would be rather awkward to fit under the tender without being unsightly.

The battery is attached to the underside of the soleplate, behind the rear bolster, by two clips made of thin springy brass screwed to the soleplate. Two brackets made from 16-gauge brass strip are also screwed to the soleplate in such a position that they make contact with the strips on top of the battery. The bracket contacting the short battery strip (the negative pole) is left plain, but the other one carries an insulating bush made from fibre or ebonite, with a 3/32 in. brass screw through the middle and a nut and washer on the back, to which an insulated wire is attached. This goes to a switch in the engine cab.

Uncoupling connector

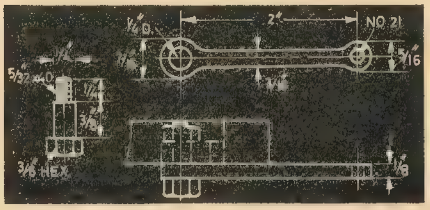
To enable the engine and tender to be uncoupled, a connector, which merely consists of a plug and socket, is inserted in the wire at the drag beam. The plug is a little brass split-pin, and the socket a short piece of brass or copper tube. As they are not insulated they should hang clear of the engine frame; but for perfect protection a short length of rubber tube could be slipped over them.

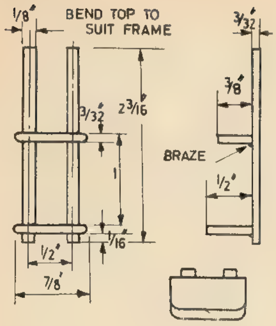
Unless a very small switch of the usual pattern can be obtained, one can be made as shown in the detail sketch. The disc is a piece of $\frac{1}{8}$ in. fibre or ebonite, the contact stud being an ordinary cheesehead screw with the head turned thin. It goes through the insulating material and has a nut and washer on the back. The lever is made like a tiny throttle lever and is pivoted on a similar screw; $\frac{1}{16}$ in. screws are fitted, one each side, to act as stop pins for limiting the travel of the lever.



Left: *Wiring diagram for the electric light*

Below: *Details of engine and tender drawbar*





The tender steps

The complete switch can be attached to the side of the cab by a brass bracket screwed to the back of the insulating disc, but file a clearance in the bracket for the pivot screw of the lever, otherwise you'll get a "dead short" on to the engine frame as this is connected to the negative of the battery. "Milly Amp" is the quickest thing on earth, but also the laziest—she always takes the shortest way home! By the same token, as Pat would remark, set the switch far enough away from the cab side to avoid the contacts on it touching the metal.

The wire from the stud on the switch to the headlight can go along under the running-board out of sight. A neat way of doing the job would be to use a 3/32 in. tube for the handrail, instead of solid rod, and run the wire through that. The best kind of wire to use would be the enamelled kind used for winding the field magnets and armatures of very small motors. I used this on my 2-6-6-4 *Annabel* for connecting the wee turbo-generator to the headlight, after I found that ordinary insulated wire soon developed bare places.

The insulated wire would be awkward to thread through a hollow handrail, whereas the enamelled wire slips through easily. The working headlight, whether oil on the old-time engine or electric on the modernised version, is well worth fitting as it gives a realistic effect when the engine is running in the dusk of evening or at night.

PAINTING

The early American locomotives were often highly decorated. In many cases the boilers were left the natural steel-blue colour of the cleading plates and the boiler-bands were of polished brass. When the whole lot was given a dose of oil or tallow, and rubbed off, the effect was very pleasing.

Smokeboxes were black, owing to the heat, but cabs and tenders were decorated like gipsy caravans, often with elaborate lining, or striping as it is called in U.S.A. The wheels were usually red or yellow and the bosses were lined out. I am not offering any specific suggestions as to how *Virginia* should be painted; I am content to leave that part of the business to suit the tastes of individual builders.

The modernised version should be all black. Why this funereal and sombre finish superseded the original colourful appearance was probably an anticipation of what happened in the later years of the first grouping of the railways of Great Britain when certain folk, whose souls did not rise above statistics levels, decided that as long as locomotives could pull trains and earn dividends it didn't matter what they looked like, or even if they were clean.

Another factor was that, in the early days, both in U.S.A. and G.B. each engine had its own regular driver and naturally he took a pride in its appearance. All enthusiasm was killed by the "common user" stunt, which incidentally sent maintenance costs soaring. It is interesting to note that the "new toys," the diesels, are usually decked out in pretty colours!

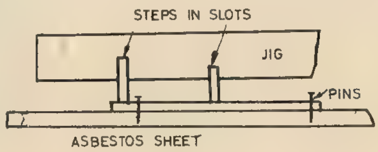
Heat resisting

Whatever colour is adopted for the little engine, the method of application is the same. What I do is to give the whole bag of tricks a good wash-down with some petrol to remove all the grease and oil; then when dry I paint it with a good brand of either heat-resisting enamel or a synthetic hard-gloss paint, such as Valspar, Sol or any similar well-known brand. I don't use undercoating nor bother about rubbing down; my locomotives are intended to do hard work and not to be showpieces, and as long as they look clean and reasonably smart I am satisfied.

A trick I usually work to make sure that the paint on the boilers doesn't go soft the first time steam is raised is to fill the boiler before applying the colour and then heat the water almost to boiling-point by the aid of a small gas-burner in the firebox.

If the heat is kept up for several hours, and a "tunnel" of stiff brown paper placed over the engine to keep off dust as much as possible, the paint will "set hard" and not even splashes of hot oil will affect it. After a run, a rub with a soft rag restores its pristine beauty and, to quote a well-known advertisement, "the more you rub it, the better it looks."

How steps are held for brazing



EPILOGUE

Well, I guess that is about all there is to say about little *Virginia*. It has been rather a task in some ways to give fully-detailed drawings and instructions for building a small edition of a type of locomotive that I have never seen, and at the same time to guarantee that it will do the job given average workmanship.

I have Forney's *Catechism of the Locomotive* and McShane's *The Locomotive Up-to-Date* (which it was when published in 1899!) and both these books give plenty of information about the full-size 4-4-0 engines of the period; but a slavish copy of a 4 ft 8½ in. gauge job would be absolutely useless as a really efficient working proposition in 3½ in. gauge.

I have found by practical experience that to get the best results the engine must be designed to suit the gauge; and it may interest those critics whose letters appear from time to time in Postbag that this has been endorsed by the several eminent chief mechanical engineers who have honoured Little Swindon or Little Crewe, as they call it, with a visit and have tried out my locomotives for themselves on my own small railway. They found no fault with my original drawings.

No complaints

I have had a considerable amount of correspondence from various good folk who are building the engine and up to the present there have been no complaints; the job seems to be progressing smoothly and judging by the sales of castings and material there will be quite a fleet of the old-timers taking the road in due course. I rather think that some of them will be capable of showing their more modern sisters how to perform the pull-and-go act!

When the valve gear is O.K. and set correctly, and the boiler can supply the steam, the only limit to tractive effort is the bite—not the weight—of the coupled wheels on the railheads; and speed is only governed by the ability of the engine to stay on the rails. Just as a miniature racing automobile can travel as fast as a full-size one, so could a little locomotive if it would stay on the line.

It is more than likely that some critics will scoff at this assertion, just as they did when I first asserted that a 2½ in. gauge coal-fired locomotive

● *Continued on page 586*

EXPERT'S WORKSHOP

A lathe filing attachment—contd.

To complete the base-casting assembly the two packing strips, *K*, are secured to its under surface. These strips, which can be seen in Fig. 5, are held in place with 2 B.A. Allen cap screws so as to form a flat bolting surface for locating the attachment on the lathe cross-slide.

After the strips have been fixed in position a $\frac{5}{16}$ in. dia. drill is put through from above by using the holes previously drilled in the base as drilling guides. The drill holes so formed are for the passage of the T-bolts that serve to clamp the attachment to the lathe saddle.

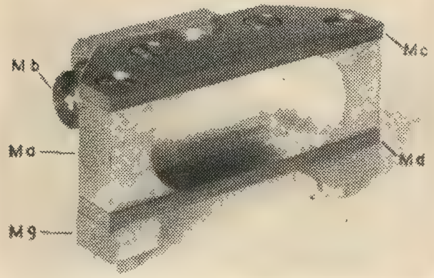
The file spindle, *L*, carries the machine file at its upper end and the crosshead, which is driven by the crank, is clamped in place towards the middle of the shaft.

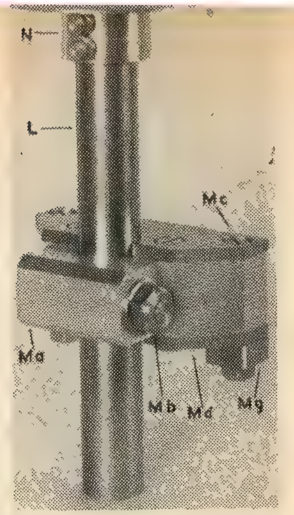
Either mild steel or alloy steel is used for making the spindle, but the material should preferably be annealed before being machined to relieve any internal stresses that might give rise to distortion when the core of the shaft is drilled out.

As it is important that the spindle should fit closely in its bearings and, at the same time, be able to slide freely, the work is turned parallel between centres and afterwards lapped.

A length of stock silver-steel or ground mild-steel rod is not a good substitute where—as in the present instance—precision fitting is called for.

After the rod has been turned 1 thou. or so over the finished size for a length of some 6 in., an external lap is used to reduce the diameter until the spindle is made a close working fit in its bearings. This is done in two stages by using a fine-grain abrasive to complete the process and impart a high surface finish to the work. If the two bearing plates and their bushes have been accurately made and fitted, the spindle should slide in both bushes simultaneously and just as freely as when entered in a single bush.





Above, Fig. 21: The file spindle, L, and the swarf deflector, N. (Other parts as previously lettered)
Left, Fig. 17: The crosshead. Ma, the body; Mb, the clamp bolt; Mc, upper guide plate; Md, the lower guide plate; Mg, crosshead guide blocks

To reduce the reciprocating weight and so lessen the working vibration, the spindle was centred in the four-jaw chuck and, except for 1 in. at the far end, the central core was drilled out to form a bore $\frac{7}{16}$ in. in dia. After reversing the work and again centring it in the four-jaw, the upper end was bored $\frac{1}{4}$ in. in dia. to receive the tang of a standard machine file.

When remounting work in the four-jaw in this way it might be thought that by slackening and again tightening one pair of adjacent jaws the work would afterwards run truly; but as there may be doubt on this point with some chucks a final check should be made with the test indicator.

Finally, the upper end of the spindle is cross-drilled and tapped to take two 2 B.A. Allen grubscrews or hexagon cap screws for clamping the shank of the file in place.

THE CROSSHEAD, M

The weight of the reciprocating parts is further reduced by making the body, *Ma*, of the crosshead of duralumin or some other light alloy, but the wearing surfaces for the outer race of the crankpin ball bearing are provided by the upper and lower steel guide plates, *Mc* and *Md*.

The body is filed or machined to an overall thickness of slightly more than $\frac{3}{4}$ in., so that when the two guide plates are finally fitted in place the crankpin ball bearing will be a close sliding fit without appreciable play.

Fig. 15: The raising blocks attached to the base casting

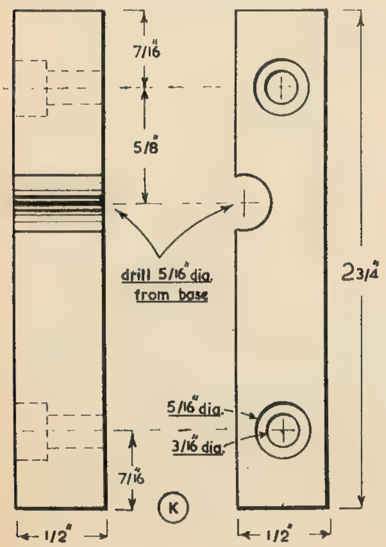
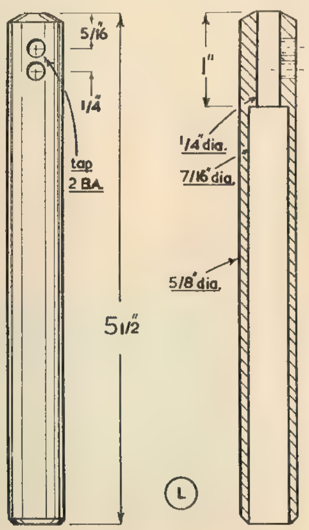
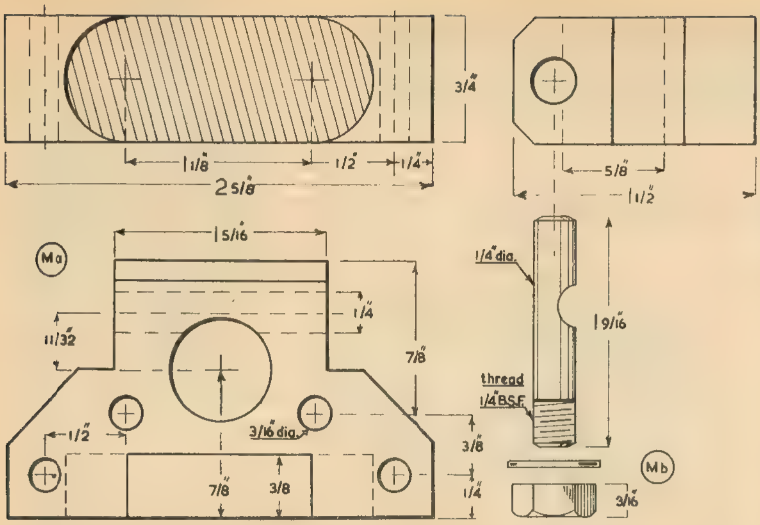


Fig. 16: The file spindle





After the work has been marked out (Fig. 19) the various bolt holes are drilled; these will serve for attaching the part to the lathe faceplate when boring the hole to receive the main spindle.

Before starting the latter machining operation the $\frac{1}{4}$ in. dia. turned rod, forming the half-moon clamping bolt, is secured in the hole drilled in the crosshead by a nut at either end. To make sure that the crosshead, together with its clamping bolt, fits accurately on its spindle it is bored to a press fit and afterwards eased to a push fit by being lightly lapped with the internal lap used for finishing the spindle bearing bushes. Making use of a lap for a final assembly operation of this kind is usually the quickest and most reliable way of obtaining an accurate fit. Moreover there should be no danger of making the bore bell-mouthed or removing too much metal, as can easily happen when a hand reamer is employed for the purpose.

The clamp bolt can now be removed and after it has been cut to length the ends are chamfered or rounded.

The chamber in which the crankpin ball bearing slides from side to side was machined by mounting the work in the vice of the vertical milling machine and using a $\frac{3}{8}$ in. dia. T-slot cutter to cut the slot to the finished length with semi-circular end faces. If the spindle with the crosshead attached is now mounted in its bearings the crosshead itself should make light contact with the vertical face of the base casting for the full length of travel.

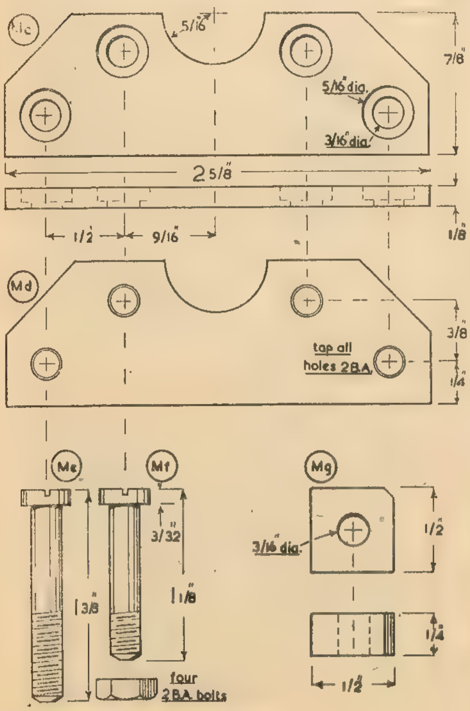
The presence of a small gap between these two surfaces does not matter because the steel guide blocks, *Mg*, are adjusted to bear on the working face of the casting, but if the contact is too close and causes stiff working a correction is made by rubbing the face of the crosshead on a smooth file. And unless the bearing face of the casting has been machined to a high finish it should be given a smooth surface by taking a series of light cuts with a hand scraper.

The two mild-steel or bronze guide blocks, *Mg*, are secured in place by the longer pair of bolts, *Me*. These blocks are carefully fitted so as to guide the crosshead throughout its travel; at the same time they prevent any rotation of the spindle about its long axis, for this would upset the accuracy of the filing stroke when the machine is in operation.

To finish the assembly the upper and lower mild-steel guide plates, *Mc* and *Md*, are cut to shape and bolted in place on the crosshead. The distance between these two plates should be adjusted to allow the crankpin ball-bearing to slide freely from end to end of the slot, but without vertical play. Where necessary, adjustment to take up play or wear can be made by rubbing the under surface of the crosshead on a smooth file.

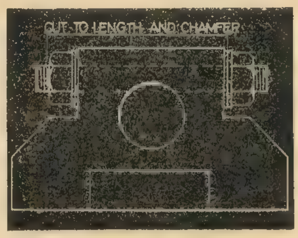
After the attachment had done a considerable amount of work the crosshead was dismantled, and it was found that, though the contact surfaces of the guide plates showed polished rub marks, no appreciable wear had occurred nor had any play or slackness developed.

Above, Fig. 19: The crosshead and its clamp bolt, Mb



Left, Fig. 20: The upper guide plate, Mc; the lower guide plate, Md; the long and short crosshead assembly bolts, Me and Mf; the guide blocks, Mg

Below, Fig. 18: Securing crosshead clamp bolt for machining



LUBRICATION

The two ball-bearings fitted to the driving spindle and the crankpin ball-bearing are packed with light grease on assembly so that renewal will not be needed for a long time. As previously stated lubrication of the reciprocating file spindle is provided for by the small oil reservoirs machined at the upper ends of both bearing bushes—and it is necessary to replenish the oil only when starting work.

● *To be continued.*

Do not forget the query coupon on the last page of this issue

READERS' QUERIES

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20, Noel Street, London, W.1.

Rewinding fire element

I wish to rewind the element of an electric fire. What is the correct procedure and from whom can I obtain suitable wire or, alternatively, a spare element? The element is 8 in. long and the marked details are: 4.2 amp., 240/50 v.—R.T., Perth.

▲ *It is not possible to advise you where to obtain suitable wire for this purpose at the present time. Generally speaking, however, it is easier and cheaper to buy ready-made elements, and, in the case of coiled elements as used in bowl fires, the resistance spirals are obtainable quite cheaply. For elements which are wound on a solid asbestos or fire clay rod or cylinder, the coil element could be straightened out and rewound on the former.*

For a resistance to carry 4 amp. and produce a temperature of approximately 500 deg. C. or 932 deg. F., the resistance alloy known as Brightray or Glowray should be used, and the wire size is 24 in. gauge. The resistance value for working on 240-250 v. will be approximately 50 ohms, and this will need approximately 33 ft of wire of the size specified. These wires are made by London Electric Wire Co. and Smiths Ltd (Lewcos), 24 Queen Anne's Gate, Westminster, London, S.W.1.

Adapting wiper motor

I am considering using a 6 v. car windscreen wiper motor on a model. Could you give me details of motor speed, current required and torque, etc.?—R.W., Dundee.

▲ *The speed and power rating of motors of this type vary a good deal, but they usually take from 1 to 2 amp. at 6 v.*

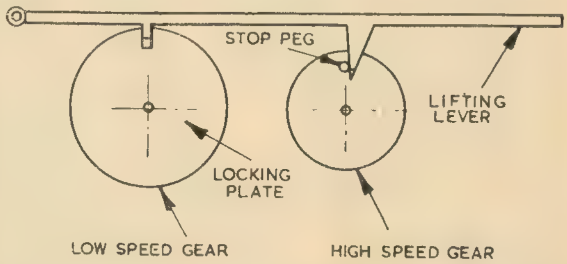
You can control the speed of this type of motor by a series resistance, but the range of speed will depend on the values of resistance employed and can only be found by experiment. A variable rheostat of the sliding or rotary type, having a range up to about 10 ohms with 2 to 3 amp. current carrying capacity, would be suitable.

Remote control

I have a Swiss clockwork musical movement which I wish to operate by remote control to give a playing period of about five or six seconds. I can arrange to start the mechanism by raising the small catch wire electrically, but I require some mechanical means of timing this period with an automatic stop. Could this be arranged by a separate clockwork movement, using one of the gears?—R.M., Greenock.

▲ *It should be a fairly simple matter to control the mechanism so that when once started it runs for a definite period and stops automatically. The usual method of doing this is by using a similar device to that employed for controlling the striking or chiming work of clocks—that is to say the use of a notched disc (or locking plate as it is called) and a lever with a tooth or detent which drops into this slot and operates the stop mechanism. To start the movement the lever is lifted in any convenient way and, immediately the locking plate starts to move, the lever is prevented from falling again until it reaches the next notch, which may be timed for a complete revolution of the locking plate—in which case only one notch is necessary—or for any part of the revolution.*

A simple method for limiting the playing time of a musical movement



Preventing rust

I have recently completed a Stuart No 4 engine and wish to take all possible precautions against rust and corrosion internally. Would it be advisable, on stopping the engine, to run in through the lubricator or exhaust a water absorbent rust preventative oil?—N.M.D., Maidstone, Kent.

▲ *Whenever the engine has been run the cylinder should be thoroughly drained and then flushed through with cylinder oil. Most types of rust preventive oils tend to dry hard or become gummy and they are not, therefore, considered to be the most suitable kinds of oil for use on the internal parts of an engine.*

Fluorescent lamp

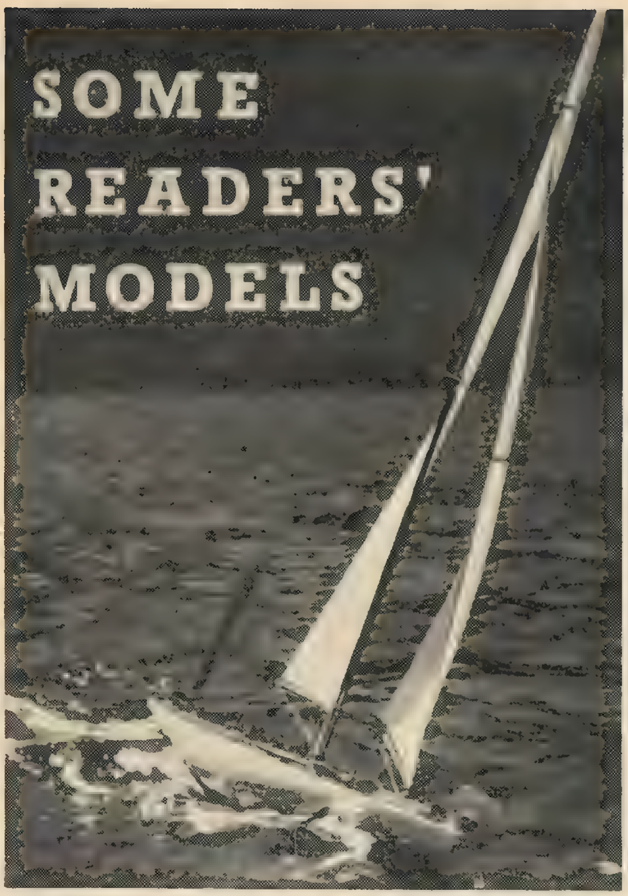
Can you explain how a fluorescent tube operates with a ballast lamp starter as opposed to the usual chokes? What, too, are the advantages and disadvantages?—R.S., Bradford-on-Avon, Wilts.

▲ *Fluorescent lamps operating without the usual choke coil and starter make use of a resistance dropper, the ballast lamp being the dropper. The filament of this ballast lamp cold will be at a low value and the voltage across the fluorescent tube will be of a value sufficient to strike the tube. As the ballast lamp reaches its working temperature its resistance is increased to a value that suits the volt drop needed by the tube. There is no special difference in the performance of either method, but the use of the ballast method is not so efficient as a normal assembly.*

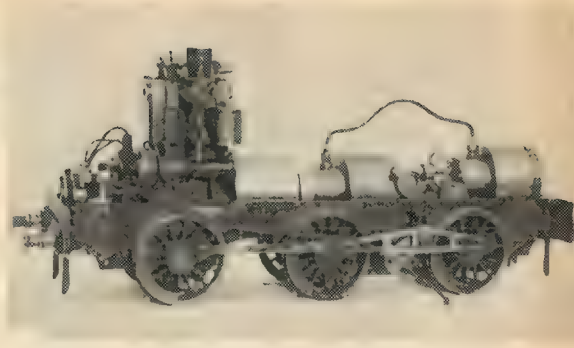
With the ballast arrangement a starter as a separate unit is not used, but there is no reason why one should not be incorporated in the circuit. The ballast could be accommodated by the use of a proper resistance; this, however, would add to the overall cost of the fitting, thus a suitable lamp is used for economy. Note that this method is not applicable to all types of tubes or tube arrangements.

Basically, the normal tube needs a choke coil of some value, a starter to suit the tube and, in addition, a power factor condenser is sometimes fitted.

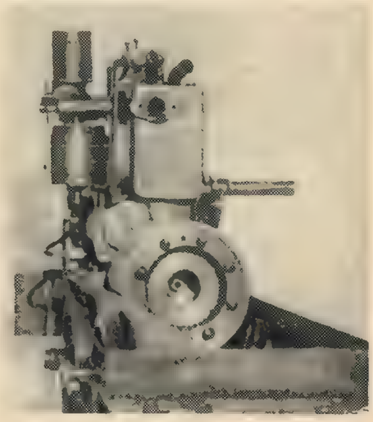
SOME READERS' MODELS



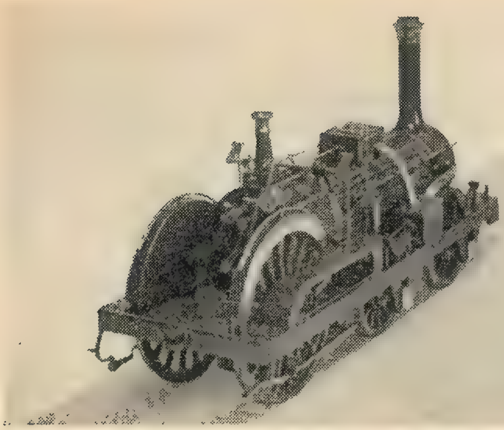
From Silvio Rota, of Milan, come these fine pictures of ALCEYDON, *a 10-rater, and* DANIEL, *a marblehead, in action on Lake Como*

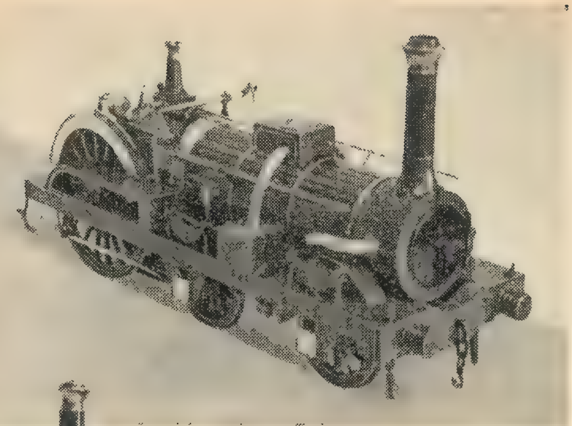


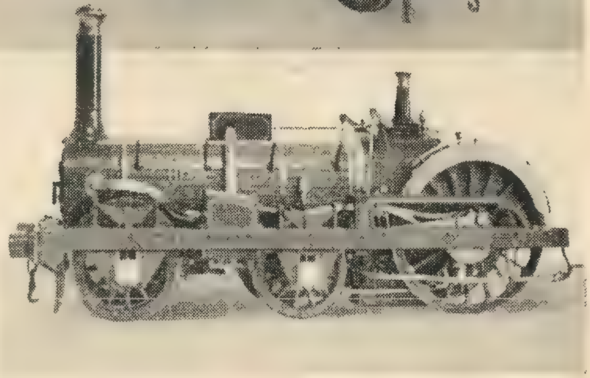
Above: An experimental version of the "1831" locomotive, to the design by Edgar T. Westbury, but modified by the incorporation of a hydraulic torque converter, by Leonard Mackey, of Wilmslow. Below: A close-up of the "1831" engine. Mr Westbury contributed an article on torque conversion in the January 3 issue



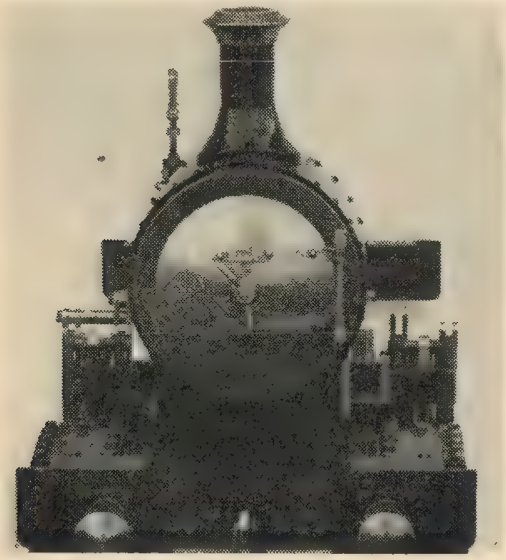
Another shot of Signor Rota's 10-rater ALCEYDON *heeling over gracefully to a gentle zephyr*

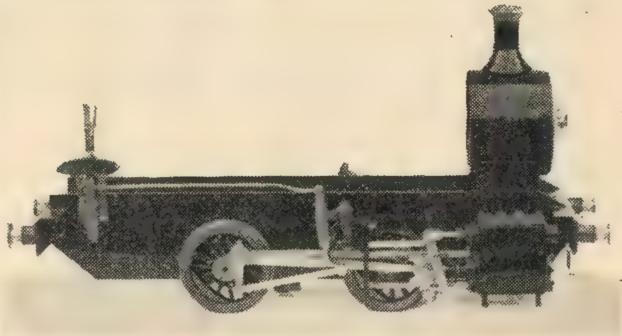


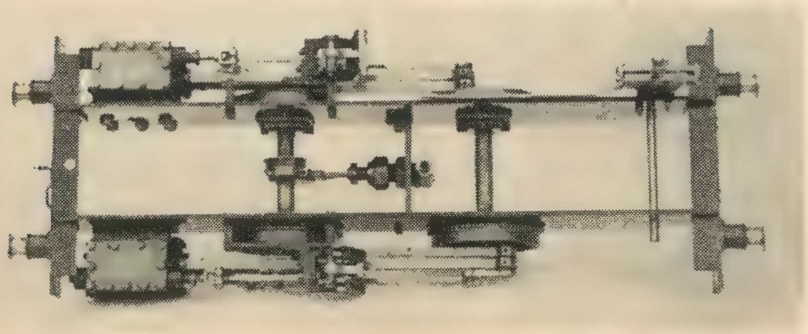




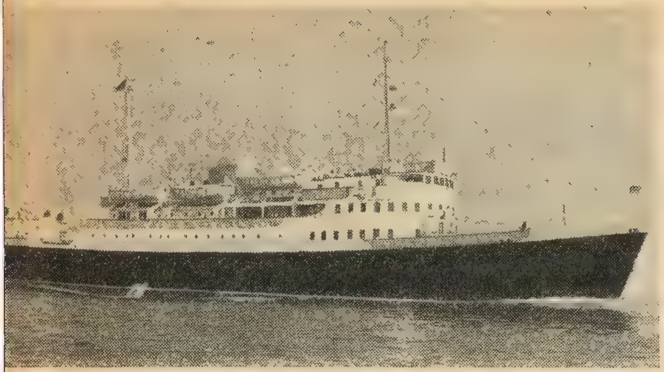
Twenty-two-year-old G. Kimber, of Coxheath, Kent, sends these pictures of his first model locomotive—a Crampton. The only castings used were the four carrying wheels. Total building time: 18 months







Three views of an unfinished JULIET *being made by L. Thorpe of Gedney, near Spalding. Centre left: front view. Above: side view, showing the Baker valve-gear fully assembled. Left: plan view, in which the two sets of Baker gear can be seen, in addition to the mechanical feed pump driven by an eccentric off the leading axle*



A WORKING MODEL OF

ST NINIAN

By EDWARD BOWNESS

Part 8—Details this week include instructions for the building of the midship superstructure of this elegant cross-Channel steam packet

Continued from 4 April 1957, pages 505 to 507

BEFORE going ahead with the superstructure I must mention that, in discussing the bilge keels with a friend who is a naval architect, he pointed out that what I had assumed to be the bilge keels [February 21] might be additional rubbing strips.

In this case the bilge keels would be at the turn of the bilge in the usual position. On writing to the builders they confirmed this. In their letter they state: "There is a rubbing strip of 9 in. × $\frac{7}{8}$ in. flat bar welded to 'E' strake from frame 51 to 77. This was specially asked for by the owners who have learned from experience that wear takes place in this vicinity at certain ports at which the vessel loads. The bilge keel is on 'D' strake and extends from frame 41 to 82; it is formed of a 6 in. flat bar welded to the shell, to which is riveted a 12 in. × $\frac{1}{2}$ in. bulb plate."

Strake "E" is the one I have numbered 4 on the body plan, Fig. 11, and "D" strake is our No 5 strake. The frames are numbered from the stern post, which is our station 0, and as the frames are spaced 2 ft apart the lower rubbing strip extends from 102 to 154 ft, or in the model 20.4 to 30.8 in. forward of station 0 on the position indicated for the bilge keel. The bilge keels proper are on the No 5 (outer) strakes and extend from 82 to 164 ft, or in the model 16.4 to 32.8 in. forward of station 0. They can be made from $\frac{1}{4}$ in. angle and soldered in position as already mentioned.

If meticulous accuracy is aimed at, the extra rubbing strips should be fitted, but for a working model they could well be ignored as they would only add surface friction and their effect would be to increase slightly the power required to drive the model at a given speed. In any case if the bilge keels are already fitted it would be advisable to leave them as they are, and only if the builder is really anxious to do so should he fit the lower ones.

MIDSHIP SUPERSTRUCTURE

This is to be built as a unit, complete with funnel, masts, boats and davits, so that it can be lifted off bodily when required to give access to the power plant and radio gear. The drawing, Fig. 38, will give a good general idea of its appearance and will help the builder to get a mental picture of the unit as a whole. This will make it easier for him to follow the description of the different parts and to appreciate their relation to one another.

The unit is a close fit between the midship bulwarks, Fig. 16, and is located fore and aft by the vertical plates at stations 3 and 8 which are shown in the plan at shelter deck level, Fig. 38, and in greater detail in Figs 23 and 28. The angles along the lower edges of the two sides, and the three stiffening beams shown in Fig. 40, will keep it in shape at this point and preserve the tightness of the fit between the bulwarks.

The promenade deck is open inside the cabins, i.e. the cabins have no floors but the deck itself forms a frame which stiffens the unit. As a further help the deck and the sides of the cabins are continued round inside the curved front. In the actual ship the cabin sides are continued round on this line, thereby forming an inner and an outer dining saloon.

The deck fittings are not shown in Fig. 38 and other features such as rails and companion ways are only roughly indicated, as at the moment we are only concerning ourselves with the main structure. The dotted lines in the profile represent the outer edge of the decks. The camber of the deck is ignored except that it is suggested by the upward curve at each end; but it must not be for-

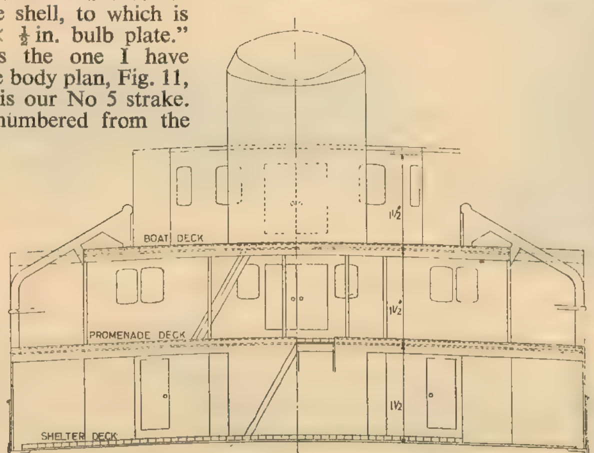


Fig. 39: Section showing after end of midship superstructure

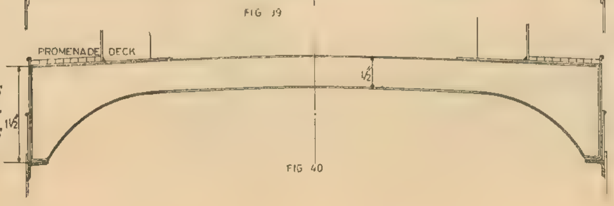
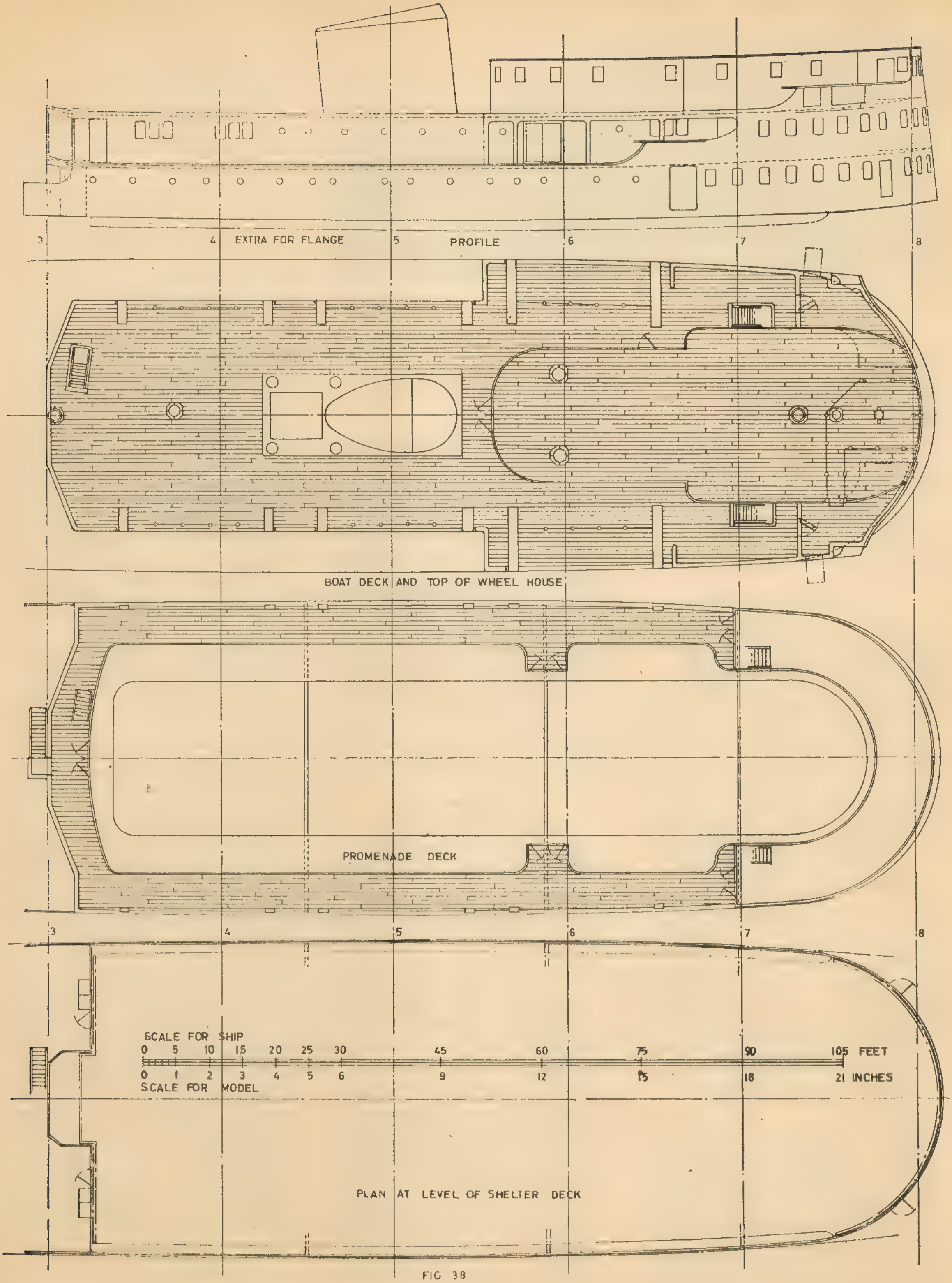


Fig. 40: Beams under the promenade decks

Fig. 38: Profile and deck plans of the midship superstructure



EXTRA FOR FLANGE
PROFILE
3
4
5
6
7
8
BOAT DECK AND TOP OF WHEEL HOUSE
PROMENADE DECK
SCALE FOR SHIP
0 5 10 15 20 25 30 45 60 75 90 105 FEET
0 1 2 3 4 5 6 9 12 15 18 21 INCHES
SCALE FOR MODEL
PLAN AT LEVEL OF SHELTER DECK

FIG 38

Port side of the superstructure Photo: *W. Ralston*

gotten. It is shown in Fig. 39 which gives details of the after end of the superstructure.

It has been pointed out already that the lines of the superstructure follow the sheer line of the ship, and this will be seen on the profile on Fig. 38. The uprights are vertical with the exception of the curved front of the superstructure which slopes aft on its forward face but is vertical at the sides.

INTERIOR FURNISHINGS

In the model the cabins are shown without interior furnishings and in many cases without floors, so as to provide plenty of air space for better combustion should it be decided to fit a blowlamp for the boiler. Certain spaces could be finished in greater detail and furnished, such as the officers' accommodation on the boat deck and the outer circle of the dining saloon at the forward end of the promenade deck, but such work is very personal and those who wish to do it would no doubt prefer to do it in their own particular way.

These people should consult the description of the ship with deck plans which were published in *Shipbuilding and Shipping Record* for 27 July 1950, *The Shipbuilder and Marine Engine Builder* for November 1950, *The Motor Ship* and the other shipbuilding magazines of the period. A visit to the ship herself would be extremely informative, and as she calls regularly at Leith docks she is very accessible from Edinburgh.

AN ADDITIONAL DECKHOUSE

On examining a set of photographs taken for this series by my friend Capt. Thomson, master of the Shell tanker *Nuculana*, himself a ship modeller of some distinction, I find that since the vessel was first built a deckhouse, presumably to provide additional accommodation, has been built on the boat deck aft of the funnel. This is of the same height as the wheelhouse forward and measures about 16 or 17 ft square.

It has four windows on each side, sliding doors with a window on each side on the after side, and three or four windows on the forward side. The windows have square corners, unlike the nicely rounded frames of the windows in the other houses.

Personally I consider the house detracts from rather than improves the appearance of the ship, and spoils the graceful outline that slopes away aft from the funnel which is, as it should be, its dominant feature. I have, therefore, decided to leave it out in the model, merely giving the particulars so that those who wish to put it in may do so. It will probably appear in some of the detail photographs which we may reproduce in this series.

BUILDING THE SUPERSTRUCTURE

In building the midship superstructure the first thing to be done is to make the sides and the curved front. These should preferably be made in one piece, but as it is unlikely one can get a piece of tinplate of sufficient length it is better to make the curved front in one piece and join it to the side pieces at the hinged doors, which are to be found on each side just aft of the lower rows of big windows.

I am preparing a drawing giving dimensions for these plates and the position of the windows, which I hope to include in the next instalment. They will be connected by means of butt straps on the inner side, as the outside must be finished flush so that when painted the joint will be invisible. There is a stiffening flange along the lower edge of the sides and material for this should be left when cutting, as indicated on the profile in Fig. 38.

The curve of the sheer line introduces a slight difficulty in flanging these plates, but the curve is so easy that it will be possible to make a good job of it. The after ends of the side plates project beyond the bulkhead to make up the extra height of the bulwark at this point. These should be faired into the midship bulwarks, Fig. 16.

The three beams under the promenade deck, already referred to and shown in detail in Fig. 40, in addition to stiffening the structure, will ensure that the promenade decks have the correct camber and that there is a firm support for the houses which have to be built on them. They are made of tinplate with a flange $\frac{1}{8}$ in. deep all round. They fit between the side plates and rest on the flanges along their lower edges, which in turn rest on the angles along the sheer strake of the hull.

They must be soldered to the sides and flanges in the fore and aft positions shown on the plan of the promenade deck in Fig. 38. Their lengths vary a little according to their positions in the hull, but if they are arranged with the flanges facing aft the fitting will be simplified.

The after bulkhead has a projecting central portion which fits on to a corresponding projection on the vertical locating plate, as shown on the plan in Fig. 38. There is a door on each side and beyond the doors are ventilating trunks. These are shown also in Fig. 39 and are continued up to the underside of the promenade deck.

They could be built up in tinplate or might even be made of balsa or other light wood and secured by means of screws from the forward side of the bulkhead. The doors should be scribed on and painted, as it is inadvisable to have openings at this level. The ends of the bulkhead should be soldered to the side plates when they are ready, making sure of a good joint where it meets the flange at its lower corners.

The upper and lower edges of this bulkhead follow the camber of the deck. Amidships the deck is 5/32 in. higher on the centre line of the ship than at the sides, and the same curvature is maintained throughout the length of the vessel. Thus, toward the ends, as the width of the hull diminishes the height of the centre above the sides also diminishes, until at the ends the two levels coincide.

All the decks have the same camber. A male and female template of this curvature should be made in stout brass or hardwood, so that at any time the camber of any deck can be tested from either above or below.

● *To be continued*

POSTBAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

MINIATURE TRAM

SIR,—Readers who like tramcars—and there appear to be quite a number—will be interested in the scale miniature car shown here. It is 15 in. gauge and is capable of carrying 27 or 30 small children (depending on size) on two decks.

Current is drawn from an overhead cable by a very realistic trolley arm which is swung at the end of the route for the return journey. There are the correct controls at each end of the vehicle, the driver sitting on a hassock-like seat near the floor.

All features of the prototype have been faithfully reproduced in the way of drop-rack lifeguards, head-lamps, destination boards, side entrance doors, etc.

Rails used are in part the orthodox trough, inset variety and in part ordinary flat-bottom spiked to heavy wooden sleepers, metal tie rods at intervals giving full security.

Wirral, Cheshire. H. A. ROBINSON.

A 15 *in. miniature tram that can seat up to* 30 *children*

THE GOOD COMPANIONS

SIR,—I, and those of the older generation, must hope that you will continue to provide the maximum space for such good contributors as Edgar T. Westbury, Duplex, Martin Cleeve and others.

It is they who give the real substance of model engineering and workshop practice. The article by J. Nixon on collets is also excellent because it shows us exactly how the thing is done.

One has come to take L.B.S.C. for granted.

I can think of two subjects which one or other of these experts might deal with in exact detail:

1. The machining technique of mounting a shaft in two bearings, considered in the alternative methods of (*a*) a solid casting or other unit which necessitates the boring of two widely separate bearings at a single setting; and (*b*) the boring of bearings individually and their subsequent mounting in place, and lapping please.

2. The making of V-slides, or machine dovetails, with attention to the subsequent scraping of the working surfaces, if these cannot be tested on the surface plate. Also, to discuss the question of gib strips. The thin modern parallel type which seems to be of American origin is, some of us think, unsatisfactory, especially on small lathes where the cross-slide has often to be exchanged for the boring table; these thin strips, relying only on pointed screws, at an oblique angle, call for frequent readjustment. The more solid shaped gib of the English pattern is surely much better.

On a quite different matter, I notice that in Expert's Workshop [March 14], in dealing with the making of a tap wrench, Duplex refers to setting over the topslide to 27½ deg. for a 55 deg. thread; but I think 56½ deg. is the accepted thing. Among other places where this can be seen is in *Know Your Lathe*, by Denfords Engineering Co., on page 64.

Ruislip, Middx. G. C. MOORE.

"CLAUD HAMILTON"

SIR,—I have read with interest your reply to C.G.R., Australia [Readers' Queries, March 21] and I shall be very glad to assist your correspondent in the matter of drawings of the *Claud Hamilton* G.E.R. 4-4-0 locomotive No 1900.

Among the collection of locomotive drawings and photographs of my father, the late Henry Greenly, there is a fully-detailed arrangement drawing as published in the *Railway Engineer* in May 1901. It would, therefore, be possible to prepare a suitable scale drawing of a working model in any desired gauge—3½ in., 5 in. or 7¼ in.

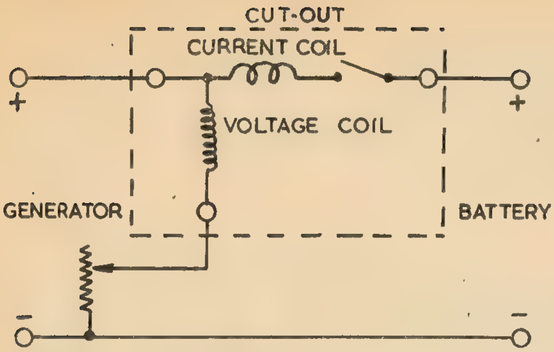
It may not be widely known that a model of the locomotive was made in the G.E.R. workshops, Stratford, at the time of the building of the full-size engine. Furthermore, both engines were exhibited at the Paris Exhibition of 1900; each being awarded a Grand Prix!

In regard to livery, numerous coloured plates were published at the time, many of excellent quality, but it is difficult to say if the colours would be considered "spot on."

Heston, Middx. ELENORA H. STEEL (MRS).

SIR,—C.G.R. of Australia asks about drawings for *Claud Hamilton* [Readers' Queries, March 21].

The thirteenth edition of *A Manual of Machine Drawing and Design*, by David Allan Low, will be found most helpful. Unfortunately it does not give a general arrangement or outline drawing of this engine but it does give a large number of detail drawings of it. Such items as cylinders, boilers, bogie, hornblocks, axleboxes and motion work are fully dealt with. It



Mr Gibbs' suggested circuit to adapt a cut out to operate on a higher voltage

also gives a complete set of drawings for a triple-expansion engine.

Colwyn Bay. ANDREW TODD.

SIR,—After reading of the request for a Festiniog saddle-tank engine to follow L.B.S.C.'s *Virginia* [Postbag, March 28], I would like to see a Great Eastern Railway's Claud Hamilton type in $2\frac{1}{2}$ in. gauge.

The Claud engines were handsome locomotives of dark blue and shining brass, and they could pull. I have never heard of one of these 110 engines failing at any time.

London, W.14. JOHN BOVEY.

● *Claud Hamilton will be No* 34 *in the series* "*Locomotives I have known.*"

SCHOOL MODELS

SIR,—I enclose a photograph of some of the models produced in this school from Christmas 1954 to Christmas 1956, both of the locomotives having been commenced at Easter 1956.

The superstructure of *Maisie* was fitted on temporarily for the purpose of the photograph. All the motion work, however, is completed, and she ticks over nicely on a few pounds pressure—much to the boys' delight.

Maisie is being made by one group of boys, and the Great Western by one boy only. All the other models were made by individual boys, many of them completing their course of metalwork with a working model.

H. B. VAUGHAN.

County Secondary Modern School, Tipton.

REAL VALUE

SIR,—I congratulate you on the article " Steps to Efficient Running " by H. J. Turpin [MODEL ENGINEER, 28 March 1957]. The illustrations make it of real practical value to all builders of the larger sizes of small locomotives.

Oldham, Lancs. R. C. ROBERTS.

SIR,—H. J. Turpin's " Steps to Efficient Running " is a very good chapter *but* I do not like his idea of attaching the pressure-gauge to the bottom of the gauge glass. The reasons are: (1) The Board of Trade does not allow pressure-gauge readings to be taken from anywhere other than the steam chamber, and (2) it would not be long before the syphon tube of the gauge became blocked with dirt deposited from the gauge glass.

Edmonton, N.9. E. W. WILKINSON.

CUT-OUT PROBLEM

SIR,—Reader D.R.A. [Queries, February 7] may not find it necessary to rewind his cut-out in order to use it on a higher voltage. For several years after the war I operated a 50 v. system using a 24 v. ex-R.A.F. cut-out of a type which I believe is still available for a few shillings. I was able to do this by connecting an external resistance in series with the voltage coil as shown in the illustration.

The total resistance in this circuit must be made such that when the generator voltage is sufficient to charge the battery, the current in this coil produces just sufficient magnetic field to close the contacts against the action of their spring. Charging current flowing through the current coil to the battery produces an aiding magnetic field holding the contacts closed, but reverse current gives an opposing field, allowing the contacts to be opened by the spring and thus preventing discharge.

If the series resistor is made variable as shown it is a simple matter to adjust for the required conditions. The approximate value of resistance required may be obtained by considering the ratio of voltages, e.g., to use a 12 v. cut-out on 24 v. add a resistance equal to that of the voltage coil, etc.

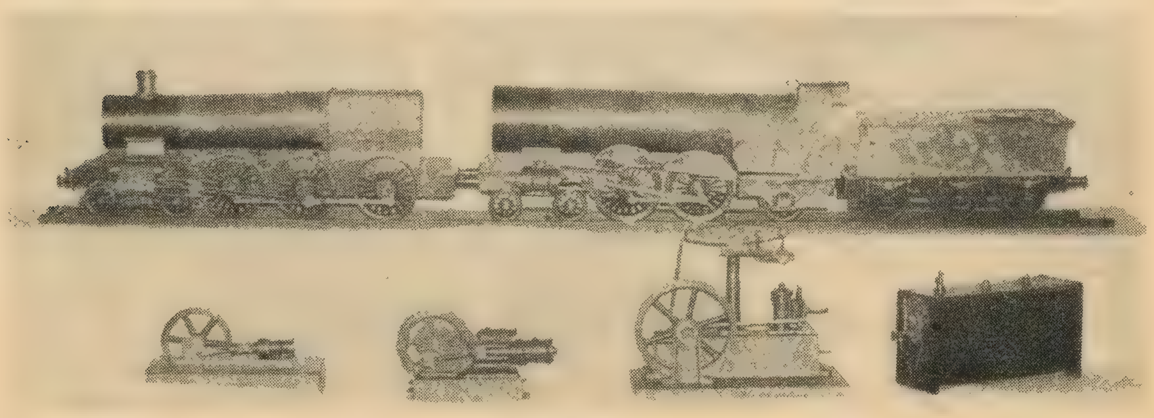
Bexleyheath, Kent. I. GIBBS.

STEAM-RAISING FAN

SIR,—While I have no doubt L.B.S.C.'s steam-raising fan is effective it would be better with a casing round it with one aperture to throw the smoke and sparks in one direction only.

There is, however, no need to make such a blower as there are still ex-Government blowers costing a few shillings on the surplus market which are readily adapted to fit a locomotive chimney. The best is the Hoover,

Some of the models produced at the Secondary Modern School, Tipton, about which Mr Vaughan writes



dual wound for 12/24 v. but it will run well on 6 or 12 v.

Incidentally, this method of steam raising for full-size engines was described in the *Locomotive Magazine* in 1926.

Personally, I favour the use of a hand-driven fan. Mine, which is well known to many visitors to the Birmingham track, is made from the gearbox of a hand-driven Bendix generator and the fan is connected to the locomotive with a flexible metal pipe.

It is, of course, more bulky than an electric blower but it can be used anywhere without mains or batteries and the draught can be easily regulated to suit the locomotive.

Sheldon, Birmingham. J. H. BALLENY.

EXHIBITION ISSUE

SIR,—Like Mr Freeman I have been a reader of MODEL ENGINEER for a number of years.

I am in full agreement with his comments on our magazine: it is excellent and unique. Also, I have to agree with our friend in regard to advertisers in MODEL ENGINEER.

In September 1955 I placed an order with a firm well known to model engineers. My order was for a set of castings and drawings.

Just before Christmas 1955 I received part of the castings and all but one sheet of the drawings. I was promised the rest in the early part of January 1956. To date I have not received anything further.

I have written scores of letters requesting the completion of my order and the bill; nothing has been done about any of it. What are our firms coming to?

I would like to see an M.E. diary on sale with useful gen for the model engineer and ads for various tools, castings, etc., which, of course, could be depended on. Also I would like to see a special souvenir issue devoted to photographs of models at the M.E. Exhibition.

How enjoyable it would be for those of use who cannot visit it. Admittedly you publish a few pictures of the exhibition models but I feel others like myself would like to see many more photographs.

St Austell, Cornwall. W. J. WILKINSON.

M.E. CLOCK

SIR,—It would appear that readers are having difficulty in obtaining supplies of Invar rod for clock pendulums.

Mr Younghusband said in an earlier issue that he had to buy five lengths to get one. Later he stated he had to wait 10 weeks for it!

On several occasions, I have obtained Invar rods for clock pendulums but have never had to wait that time or buy more than I required. I have always obtained my supplies from G. P. Wall, Pinestone Road, Sheffield, who are, I believe, the actual makers.

The first time I wrote I asked them to forward a pro forma invoice and on receiving it I sent off my cheque at once. The goods were at the door within 48 hours.

Eastbourne, Sussex. B. F. ROBINSON.

TAKE THE LOT

SIR,—It was with a tinge of envy I read [Smoke Rings, March 28] of the model engineer who is emigrating to New Zealand. He has absolutely no fears for the future of his hobby as model engineering is really popular with the Kiwis who are, by the way, most mechanically minded.

As for his problems, the mains voltage on both islands is a.c. 220 v.; prime movers of 1 h.p. or over must be registered with, I think, the Department of Trade; and all electric wiring must be done by a registered wireman.

As for model engineering requisites, he can do no better than to take everything possible, as tools are very much more expensive there than here. One or two sets of castings for future jobs, or for gifts to fellow engineers, would also be most invaluable.

Goods taken into the country by an emigrant are usually treated most favourably by the custom officials, but goods sent by mail are liable for import duty plus, of course, the high rate for freightage.

Sea mail takes about three to four months. Airmail six to eight days to the large towns. Insurance for the voyage is worth while, as almost anything can happen to goods in transit.

I will be most happy to help with any further queries.

Yeovil, Somerset. P. WEBBER.

REMPSTONE RALLY

SIR,—New Zealand reader Mr Hall [Club News, March 21] would like to see a traction engine rally when he visits the old country this year and Clubman mentions the rally to be held at Rempstone on June 29, 6.30 p.m.

On behalf of the committee, of which I am a member, I thank Clubman for the publicity and I am pleased to inform him that Mr Hall will be assured of a good welcome.

This rally was the largest held in the country last year (as regards number of engines attending) and we hope to put on an even better show this year. Several owners have promised to bring along engines that have never attended rallies before, including showman's types which have not been on exhibition for years.

All our committee members are MODEL ENGINEER readers, myself having taken it since 1933.

Leicester. A. E. PAGE.

DEAN SINGLES

SIR,—I am not yet entirely convinced concerning the shape of the axlebox covers on the Dean Singles. The octagonal effect seems too obvious in some photopraphs to be entirely due to lighting effects, particularly on the bottom corners, and it is most noticeable in dead side views. The photograph [Postbag, March 21] shows a cover with round corners with a very slight octagonal effect due to lighting.

I do not know the source of this photograph but is presumably of a model, possibly Mr Webster's; whether the shape is right or wrong there are four other errors.

(1) The proportions of the cover are wrong. Width to height ratio on official drawings is 7 : 8 and this is confirmed by photographs. The photograph on page 444 shows a ratio of 7 : 8.7.

(2) There appears to be a third stud and nut in the centre of the top of the box where there should be a hinged lid lubricator.

(3) The edges of the hornchecks which protruded through the frames were not carried round the top of the opening.

(4) The springs had nine leaves not 13.

Birmingham, 26. J. H. BALLENY.

MODEL BOAT RUNS

SIR,—Your article "Whither Power Boating?" [January 31] caught my eye. In fact one or two thoughts came to mind. I must admit that I am completely out of touch with events in England and the following may be worthless. However, this is how I see it.

1. A pilotage course for power boats equipped with radio control.

Briefly such a course could easily be marked out by buoys on any suitable body of water. The contestants would be required to pass certain buoys on the port-side and others on the starboard side. If the body of water happened to be small, contestants might be required to bring their craft back thus reversing the outward-bound course.

In other words all craft would return to the starting line. I believe judging could be accomplished by a points system, each craft being rated according to the manner it passed

POSTBAG . . .

each buoy and its correct position in relation to passing other competing craft. Mechanical ability would also enter into the scoring and the skill of the "captain" bringing his craft home.

2. A reliability and distance trial. If judged on length of running time and distance travelled such might well have a tendency to interest the internal combustion brethren. It could tempt them to build larger and more seaworthy models and perhaps slow-running marine engines similar to the Bolinders and Palmers. These I believe are built in two-cylinder models and run on the two-stroke principle. Is it too much to anticipate a model marine engine designed to run on paraffin ?

3. A manoeuvrability trial for power boats equipped with radio control.

Such a contest might require a boat to come alongside a dock, to reverse out of its position and steam away again. Perhaps, it could pick up some small floating object in a scoop net attached first to the port then to the starboard side and execute turns within a given radius. Natural weather conditions would have a tendency to stiffen competitive conditions. A really tough test would be to require certain of the manoeuvres to be executed when in reverse.

I always enjoy reading your journal whenever it arrives Stateside. Now that you are including articles on boats it is doubly interesting.

Buffalo, U.S.A. JOHN U. COCKIN.

EARTHING DANGER

SIR,—I have made a drilling machine from Cowell's castings, fixed and travelling steadies from scrap, and recently an adjustable grinding rest with my own improvement of wing-nuts to avoid searching for the spanner. Moreover, when the wing-nut is tightened the rest does not tilt from the angle set by the gauge.

With regard to the subject of earthing electrical apparatus, a neighbour was nearly killed recently when carrying a properly earthed hand-drill in one hand and the cable (in a bundle) in the other. The cable was attached by a three-pin plug to the mains, and I presume there was a leak in the cable.

The point is that if the drill had not been earthed he would not have received the shock, as he was indoors and standing on lino and there would not have been a path to earth for the current.

Is it not a fact that an earthed tool is sometimes as dangerous to touch as a water-pipe, if there is any chance of touching the other hand on a live wire ?

Bournemouth, Hants. E. DAVIES.

MAKING A PANTOGRAPH

SIR,—After reading Duplex's article "Mechanical Drawing Aids" [MODEL ENGINEER, February 14] which shows a pantograph, I decided to try and simplify matters a little as I have no means of metal turning apart from carbide tools on a wood lathe.

After trying normal screws and finding the joint too free I sorted through my junk box for ready-made bearings. I finally settled for arms made from very dry maple floor-boarding, ripped to suit bearings (see drawing), with small ball-races taken from a bombsight, although any other small race would have done.

These were made a press fit in holes bored in the arms and a smear of resin glue secured them.

The pivots were made from the same material, the bearings being fitted to these with a woodscrew with a countersunk head fitting to the slight bevel in the inner part of the race. A small washer was fitted between the race and the arm for clearance.

Providing sheet metal is available for the pivot points, countersunk metal thread screws can be used and tightened up solid, leaving the race free.

York. E. RUDD.

L.B.S.C.'s NEXT

SIR,—Apropos L.B.S.C.'s next locomotive serial—what about one of the Lima Locomotive Company's famous Shay engines ? They will "turn on a dime" and pull like nobody's business, and it would be a popular serial with the American and Canadian readers.

I feel that *Virginia* was a welcome break from the usual run of British locomotives, for with all that is now "on file" almost any of the modern British locomotives could be built from L.B.S.C.'s previous gen.

Alternatively, why not—if we *must* revert to a British prototype—give us the know-how on a Beyer-Peacock Garrett articulated ?

Either of the above suggestions have the merit that the resulting product would be a great puller and yet smile at sharp curves.

Edinburgh, 3. W. LOCH KIDSTON.

SIR,—I'm with John Bennet in that it is time for a narrow-gauge locomotive.

A 5 in. gauge is too large; I agree with J.N.M. I don't think a $3\frac{1}{2}$ in. gauge model of a narrow-gauge would be too large for those who normally, prefer 5 in. gauge. On a smaller scale, in $2\frac{1}{2}$ in. or $1\frac{3}{4}$ in. gauge it would suit the average model engineer and help to revive the smaller gauges.

I prefer *Taliesin* to *Prince* on the Festiniog Railway, which would be quite a size. But there are other locomotives which are suitable.

The Talyllyn, Vale of Rheidol, Ravenglass and Eskdale, and the Romney, Hythe and Dymchurch would provide suitable prototypes. Let's have a change from 4 ft $8\frac{1}{2}$ in.

Ashford, Kent. C. E. CARTER.

VIRGINIA . . .

Continued from page 574

could haul a living load and keep on doing it; but it has been proved.

Some years ago when the miniature motor-racing fraternity were clocking "full-size" speeds a correspondent told me that for the sake of curiosity he had tried a $3\frac{1}{2}$ in. gauge locomotive on a test stand with the flywheel removed from the axle of the friction wheel. This put the engine on the same footing as the little racing cars, which of course always run "light"; they never haul a load. With 80 lb. boiler pressure, full regulator and 25 per cent. cut-off, the driving wheels spun at a rate that would have knocked up 86 m.p.h. had the engine been on the rails.

I don't know what the maximum safe speed of a $3\frac{1}{2}$ in. gauge locomotive would be on a straight line, as I don't build them for the purpose of testing to destruction, but an engine built to my design, running on a continuous track and hauling its owner, attained a speed of just over 18 m.p.h., then jumped the road at the entrance to a curve and crashed clean through a featherboard fence. All the damage it sustained was a distorted smokebox front and a bent corner of the buffer-beam. The owner was not so fortunate, as he got a lacerated arm and a dislocated shoulder.

So, for the present, "Goodbye, Virginia," as the song said; I'll bear in mind the requests for a few hints on a larger version but I would remind those interested that blueprints can be obtained for Walt Disney's *Lilly Belle*, a $7\frac{1}{4}$ in. gauge locomotive of the same type, which was illustrated and described in this journal some time ago.

However, she differs in many respects from your humble servant's practice, thouch she could easily be modified to conform with it. ▣

CLUB NEWS

★ Edited by THE CLUBMAN ★

NO model engineer need be a lone wolf in the Watford area. Watford model engineering club has a welcome for him at St Mary's Parish Hall on any Wednesday night. However shy he may feel the club members will thaw him out within three minutes of his arrival.

The meetings open at eight and are full of variety, with the interest ranging from timepieces to radio control, from lawn mowers to locomotives. Anyone who would like to see for himself should send a note to secretary W. J. Steer at 14 Warwick Way, Croxley Green, Rickmansworth, or—says Mr Steer—" just come along."

During the year a dozen charities were helped by the club's portable track and members' locomotives, quite apart from the pleasure given to children. " To extend this work," writes Mr Steer, " we are now constructing another locomotive, a project that is giving good exercise in organisation and co-operation."

In addition, some good running was had on the Chipperfield track. It is, therefore, not surprising that the members at their annual meeting should have expressed great satisfaction at the year's work. Their consistent attendance at meetings reflects the interest aroused by the varied topics which come up for discussion.

And now, says Mr Steer, they are looking forward to another season of hot oil and burnt fingers.

BRIGHOUSE DID WELL

While the weather might have been kinder to **Brighouse S.M.E.E.** it did not shorten the society's programme last year. Indeed, an extra date was added in September by special request —another visiting day in a year when these events were excellently supported by the society's friends. The public open days were also well attended, though less well than in the previous year, and the 35 members at the annual meeting were shown a pleasing balance sheet despite the lack of an exhibition.

Secretary A. B. Knowles, I am glad to record, did not forget the part played by the ladies whose catering helped towards the year's financial success. " Without their unselfish support," he said, " this would indeed be a problem."

C. W. Sykes won the Miller Trophy with his excellent model tug faithfully powered by live steam. The Blakeborough Trophy was not awarded, there being no entries.

Brighouse's officials for 1957 are W. D. Miller, president; C. N. Sunderland, vice-president; H. Byram; chairman; E. Moore, vice-chairman; H. Taylor, treasurer; A. B. Knowles, secretary; D. F. Haviour, publicity officer; P. Crowther, B. Wood, and M. Oates, auditors; and H. Byram and E. Moore, librarians.

STAND BY, SUTTON

I have an important announcement from **Sutton M.E.C.** The silver cup presented to the club by the late Sir Malcolm Campbell is to be offered in a competition known as " Craftsman of the Year," and the first event will be held in the form of an exhibition on Sunday. All models finished, begun or worked on since 1 January 1955, two years ago, are eligible.

There will be two judges from outside, one of them Edgar T. Westbury. In later competitions the judging will be concerned with the past year's work, notes being kept of the amount completed at the time of the previous competition.

Secretary A. C. Jensen (18 Brambledown Road, Wallington) asks for as many models as possible whether or not they are actually competing for the cup. A copy of the rules may be had from the assistant secretary, D. C. Blunden, at 15 Nonsuch Walk, Cheam.

EASTER BID

For Harlington Locomotive Society a fine Easter will mean a further locomotive trial in a bid for the club shield, held at present by Harrow and Wembley.

Two changes were made at the annual meeting. The chairman is now George Atkins and the assistant locomotive superintendent is S. Gregory.

VERSATILITY AT VERULAMIUM

At the annual dinner of St Albans M.E.S., a competitive exhibition of members' work was held which illustrated both the wide range and the progressive spirit of their activities. The models shown included most of the popular types, but were outstanding mainly because of the experiments both in design and methods of construction which they embodied.

Typical examples were Mr R. Mapplebeck's impulse turbine marine plant, which has made successful trials at well over 100,000 r.p.m.; Mr Waller's radio-controlled steamboat, which incorporates a very wide range of operations, including internal and navigation lighting; two notable racing hydroplanes, the record-breaking C class *Foz* by Mr R. Phillips, and Mr S. H. Clifford's latest A class boat *Poly Ester*, which has a streamlined hull in reinforced glass fibre.

Other models ranged from a tastefully-furnished doll's house to a waterline clipper ship in full sail. All exhibits displayed excellent workmanship and finish.

M.E. DIARY

April 19.—Port Talbot, Neath and District S.M.E. Members' Difficulties, Old Melyn Works, Neath, 7.15 p.m.

April 21.—Harrow and Wembley S.M.E. full-scale Track Day to open track season. Sutton M.E.C. " Craftsman of the Year."

April 23.—32nd Model Railway Exhibition, Central Hall, Westminster (April 23-27).

April 24.—Bristol S.M.E.E. Kerswell two-stroke, Folk House, College Green, 7.30 p.m.

April 26.—World Ship Society (Merseyside branch) films. I.M.E. diesel engine lubricants.

April 27.—S.M.E.E. "Lifts," B. P. Hutton of Marryat and Scott, 14 Rochester Row, London, 2.30 p.m. Glasgow S.M.E. talk on a White Steam Car.

May 2.—Ilford and West Essex M.R.C. exhibition. Lord Brabazon of Tara and Lord Northesk, Ilford Town Hall, 3 p.m.

May 3.—North London S.M.E. annual meeting, E.R. Gas Offices, New Barnet, 8 p.m.

May 4.—S.M.E.E. special rummage sale, 28 Wanless Road, London, 2.30 p.m.

May 11.—Andover and District M.E.S. Andover Traction Rally, 12 noon; first event, 1.30 p.m.

Classified Advertisements together with remittance should be sent to Model Engineer, 19-20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Workshop Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

Wanted. Myford ML7, would buy complete workshop, cash. Can collect London area.—2, Isabella Road, Homerton, London, E.9.

Wanted. Swivel Vertical Slide for Myford. Also clock gauge.—Woodman, 40, Tintagel Road, Orpington, Kent.

Drummond-Myford Lathe, V-drive, 1/3 h.p. Crompton motor, stand, clutch, steadies, vertical slide, many tools and accessories. Progress $\frac{3}{8}$" drill, vertical motor. Sawing machine as described and designed by "Duplex" with motor. Prefer to sell as one lot. Offers.—Box No. 8481, Model Engineer Offices.

ML4 on Stand, chucks, accessories, $\frac{3}{4}$ h.p. motor, £28. Drill to $\frac{3}{8}$" on pillar, $\frac{1}{2}$ h.p. motor £7, offers.—365, New King's Road, Fulham, Renown 3777.

New Tools H.S. parallel hand reamers, 5/32", 7/32", $\frac{5}{16}$", $\frac{3}{8}$", $\frac{7}{16}$", $\frac{5}{8}$", six for 27s. 6d. C.O.D. 1s. 4d. Precision needle, files, 8 assorted, 7s. No. 1 M.T. drill shanks, length 7", drilled $\frac{1}{4}$", $\frac{5}{16}$", $\frac{3}{8}$", set of 3 for 7s. 6d. Circular diestocks, $1\frac{5}{16}$", 3s. 6d.; $1\frac{1}{2}$", 4s. 6d. H.S. taps $\frac{3}{4}$" × 26 t.p.i. Taper S. & P. 4s. each.—A. King, 152, Halfway Street, Sidcup, Kent.

Small Treadle screw-cutting lathe. Bench drill vice. Heavy cast iron lathe stand. V-grooved treadle wheel. Several other treadle wheels.—Pike, 36, Brenthouse Road, Hackney, E.9.

ML7 Motorised, 1/3 h.p., a.c., 3-jaw, 4-jaw and Jacobs chucks. Swivelling vert.-slide, machine vice, T.D. indicator, fixed steady, rev. switch, tray and bench, 28 lb. brass rod, etc. Bargain, £65.—2, Alderbrook Cotts., Stone Cross Road, Crowborough, Sussex.

$\frac{1}{2}$" Bar Capstan with collets, c/sh., £6. Horizontal miller 16" × 8", £4. D/E foundry grinder 16" × 2" wheels, £4.—R. Heaton, 23 Grange Road, Birmingham 6.

Wanted. Adept Lathe and accessories. —Box No. 8492, Model Engineer Offices.

NEW

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model S-16
inch scale (no mm)
.001" Vernier
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3" Atlas Lathe B.G.S.C. on firm bench with motor, countershaft, reversing switch, 4" 4-jaw chuck. 3" S.C. chuck, vertical slide, various centres, full sets lathe tools, etc., £40.—Box No. 8488, Model Engineer Offices.

MODELS AND FITTINGS

Wanted. "O" Gauge clockwork locomotives and tin-plate coaches. Lowke, Bing or Marklin. In pre-group colours for preference. Write giving details to—21, Craddocks Avenue, Ashtead, Surrey.

Wanted. Old 1" to $1\frac{1}{2}$" horizontal steam engines for rebuilding purposes.—Biggerstaff, 222, Lockwood, Winnipeg, Canada.

5" or $7\frac{1}{4}$" Locomotive. Also 2" scale traction wanted. Any condition if ncomplete. —C. Arnold, 8, Homestead Way, Northampton.

"Britannia" Steam Locomotive $3\frac{1}{2}$" gauge, perfect condition, built about 1951. Excellent workmanship. What offers? Can be seen by appointment.—D. G. Morgan, 56, Gibson Road, Birmingham 20.

"Juliet" $3\frac{1}{2}$" Gauge as new, engineer built, with matched tender, £45. Stuart Sirius twin high speed steam engine, £8 10s. 6 volt car radio, £10. Electric guitar, six stringed, £8. Miniature camera, £1.—J. Taylor, 10, Bainton Grove, Woodmansey, Beverley, E. Yorks.

Castings, Drawings, boiler materia for $3\frac{1}{2}$" 0-6-0T. Misc. castings, L.B.S.C., Greenly, books, 100 M.E.s inc. 1956 to date. Bargain, £17.—31, Nutgrove Avenue, Bristol 3.

Wanted. Army Portable Blower and vertical boiler 24" high, 80 lb.—Latimer, Rockall Ballygihen Avenue, Sandycove, Dublin.

Thetford Town. Drawings and castings value over £20, £15 o.n.o.—Ingram, Pightle, Fryerning, Ingatestone, Essex.

$1\frac{1}{2}$" Scale showman's caravan, three-quarter finished, £8 or nearest offer.—E. Sims, 75, Oakleigh Road, Stratford-on-Avon.

E.D. Radio Control suitable boats, planes, etc. Long range, cost £4 10s.—best offer.—48, Townsend Road, Ashford, Middlesex. Phone 2781.

Ships In Bottles in kit form, complete with instructions, plan, shaped hull, glue, etc., model of a three-mast barque, 6s. plus 6d., p. & p.—Coopercraft, Park Grange, Shipham, Thetford, Norfolk.

Wanted. Any Parts or castings for $\frac{1}{2}$" scale "Princess Royal"—Cox, 73, Warwick Way, Victoria, S.W.1.

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Wanted. Gauge "O" steam locomotives.—Box No. 8493, Model Engineer Offices.

Do You Collect obsolete Dinky toys and Hornby "O" gauge rolling stock, or would you like to sell some? In stock are Dinky toy ships, army equipment, cars and a few aircraft. Send for leaflet with prices but expect considerable delay as they are not off the press yet; or why wait at all? Make an appointment to call. Phone SHE 1885 or write—L. Bolton, "Snugary," 14, Findon Road, Shepherds Bush, London, W.12. S.A.E. speeds all replies.

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Tool and Materials 9d.
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Marine Engines for Sale. B/L Uniflow and Eclipse, 50s. each. S.J.A. ⅝″ × ¾″ slide valve, 18s. S.T. 7/16″ × 7/16″ d.a. engine, 12s. 6d. Wanted S.T. double 10 or similar. After 6 p.m. or write—HARRIS, 24, Elthorne Road, London N.19.

54″ Coal-fired Tug, new throughout (M.E. 2/2/56) larger funnel, mechanical improvements, easy conversion oil-firing, £48. Without machinery £21. Collection. 48″ steam cruiser, new (M.E. 7-3-57), £29, carriage extra. ⅞″ × ⅞″ d.a.s.v. fabricated, ballraces, £4.—A. BEAUMONT, "Waynefleet," South Wootton, King's Lynn.

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Holiday Guest House for models enthusiasts and their families. Model ship makers specially welcome. Pleasant parking for touring caravanners. Write MR. E. T. MANT, Mill House, Wigginton, Nr. Banbury, Oxon.

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Young & Son. Material and tool dealers, watch, clock and jewellery repairers.—133, London Road, Chippenham, Wilts.

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27 Volumes M.E. 88 to 114 inclusive, unbound, offers.—D. KING, "Steeple-Court," Botley, Southampton.

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Loco Enthusiast with lots of room but no time offers house rent free to counterpart, prepared also to undertake gardening and house maintenance evenings and weekends. Write—TARVER, 39, Beech Grove, Preston, Lancs.

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M.E.s Urgently Required. Volume 54, prepared to purchase quantity containing same.—BLACKMORE, 36, Jonathan Road, Fareham, Hants.

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For Sale. "Model Engineer," unbound, parts and complete years, 1938-1956 incl. Also "Model Railway News," 1925-1956. "Model Railway Constructor," 1934-1956. Details.—32, Cropthorne Road, Shirley, Birmingham.

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Kohler, 1½ k.b.a., 110 a.c. lighting plant, step up transformer, 230-240 volts, unused kit of spares. Can be converted to T.V.O., £45.—ROGERS, Seamer, Stokesley, Yorks.

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Model Engineer. Volumes 98 to 105 inclusive, bound. 106 to date, unbound. One bound volume odd copies 1945/7. Allchin tender and hornplates, odd castings, etc. Offers?—DAVIES, 146, Foster Road, Trumpington, Cambridge.

22 Volumes, Model Engineer, unbound, volumes 94-115, £5 10s.—MANN, 15, Cranmere Avenue, Northampton.

Horizontal River Launch Boiler 1′ 4″ dia. × 2′ 1″ long single furnace with fittings, £15. Stuart Sirius coupled 6 volt, 5 amp. dynamo, £10.—MINNS, 8, Lloyds Avenue, E.C.3.

Sine Bar. 5″, bargain, £5.—136, Grantham Road, Manor Park, London, E.12.

Wanted. Oil Burner with blower, to burn 200 sec. oil. Complete. Approx. 20-25 g.p.h.—JENKIN, Lindfield, Sussex. Tel. 2333.

Formulas All Kinds, catalogues free.—KEMICO, Park Ridge, 8, Illinois, U.S.A.

Rotary Milling Table castings with gearwheels, 30s. Eccentric turning fixture, 15s. 10 lb. large dural offcuts, 15s. 12 lathe tools, 10s. Toolpost suit ML7, 8s. 6d. 250 M.E.s. Offers.—Box No. 8490, MODEL ENGINEER Offices.

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M.E. QUERY COUPON APRIL 1957

Model Engineer Exhibition AUG 21-31

NEW HORTICULTURAL HALL, WESTMINSTER

THIS YEAR'S ATTRACTIONS

THE ORGANISERS are determined to make this year's Exhibition the greatest ever so far as attractions are concerned. Already a big programme has been worked out in detail, but with still four months to go, much more will be achieved and there are several surprises in store. The foregoing programme, therefore, is not a complete one.

Such well-tried and popular features as the water tank and the live steam track will, of course, be included. The Exhibition could not function without them or the tireless enthusiasm of the Societies and Clubs manning them. However, demonstrations will this year be considerably enlarged and centralised. In addition to individual demonstrations of sail making, boat building, period ship modelling, metal working, soldering, brazing, etc., commercial firms will show the making of model aircraft and also plastic assembly and finishing.

The R.A.F. is giving a display which shows two high speed flying models of jet fighters. These are real jets driven by compressed air, which take off from a circular runway and fly independently at variable speeds in a circle of 30 ft. in diameter. The flight of the models is synchronised with a tape recording of the take-off and landing procedure between the aircraft and the control tower as it is actually done at R.A.F. stations. The models are built accurately to scale with retractable undercarriages.

Other attractions will be provided by the National Clubs and by the Services and Nationalised Industries. Vickers Ltd. will be giving a large display showing the many activities of their model engineering societies and this promises to be one of the biggest attractions at the Exhibition.

Be sure to make a note of the date

AUG 21st—31st

NEW HORTICULTURAL HALL, WESTMINSTER, LONDON, S.W.1

It is not too early to think about exhibiting your model at the "M.E." Exhibition with the possibility of winning one of the numerous awards. Full details and entry forms are obtainable from the Exhibition Manager, 19-20 *Noel Street, London, W.*1. *Closing date for entries July* 15.